

# SCIENCE

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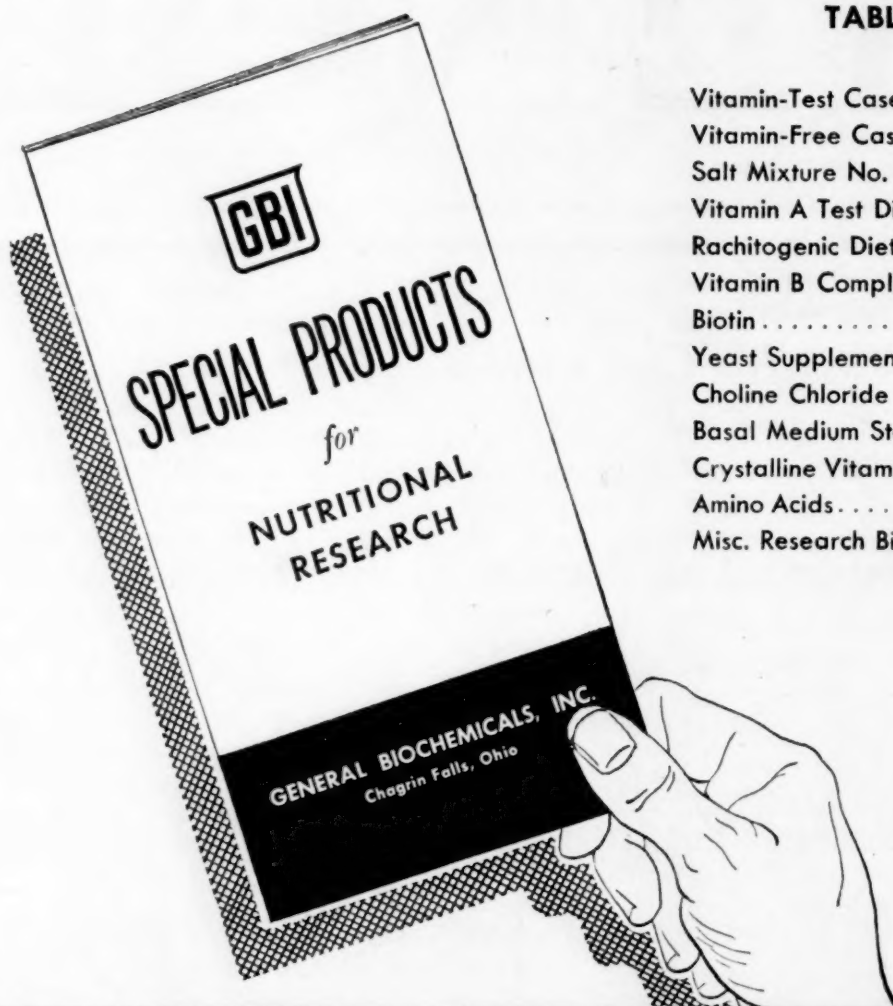
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# SCIENCE

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## Aging of Tissues: The Necessity for Research

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THE DESIGNATION OF A BIOLOGICAL and certainly of a sociological process as aging is perhaps unfortunate. In many minds it at once indicates a concern not in the change and readjustments in tissues and in human relationships chronologically regulated by time but in an irreversible state, senility, that finds its end reaction in the naturalness of death. Such a finality of biological and social adventures, while deserving both interest and care, of their nature fail to lend themselves to investigation with the hope of acquiring information that may be applied in a usable and constructive fashion. To prolong senility and the unhappiness usually associated with it would, in truth, be a vivisection. The statement which is to follow is therefore not concerned with senility as an age entity but with acquiring information about those processes which develop in all animal and plant tissue as a result of such tissue as organism being subjected to a life through time which may ultimately lead to senility and, if such be possible, to a termination in senile, physiological death.

The influence of the age of tissues in modifying, if not in determining, types of disease processes in the animal organism has been recognized for centuries, and yet these observations in general have certainly been treated in a superficial, if not an incidental, fashion. The phenomena of tissue resistance as well as susceptibility, in which the factor of age either influences or in a large measure determines these states as the individual as organism advances through different segments of the life span, have not been assigned the importance which they would appear to deserve. This does not imply that the advent of certain specific diseases and tissue modifications of a degenerative order has not been associated in the minds of investigators with such age segments. It does mean that observations of such an order have usually been made in a casual fashion without attempting to disclose the basic nature of chemical cell modifications, the products of aging which may be the factors determining the advent of degenerative

alterations in tissues and which regulate, in a measure, their susceptibility or resistance to certain outside agencies, or the cause for specific disease states.

The influence of the age of tissues in terms of their susceptibility is shown very early in the life span by our recognition of a group of disease processes as specific pathological entities designated as the diseases of infancy and childhood. Such states may develop in adulthood or at even more advanced age periods, but they are predominately more frequent in younger tissues and in such tissues of specific cell types. Certain of these diseases have been shown to be due to viruses which prefer an intracellular order of existence. At such an age period intracellular material would appear to afford a properly chemically constituted culture medium for these living agencies of disease, and as the aging process develops it may well be that this living medium so changes in its composition that it becomes less appropriate for the life and multiplication of these bodies. Age as a modification in intracellular chemistry with or without a change in morphology (3) may have imparted to such cells and the tissues which they constitute an element of resistance to invasions by disease-producing entities. Why do we speak of anterior poliomyelitis as infantile paralysis unless it is due to the likelihood that in the infant and young child motor anterior horn cells of the spinal cord are more susceptible to the invasion and proliferation of the virus of this disease than is the case for these cells at more advanced years or in senility? It is possible that as these cells live into more advanced age segments they may become protected against the virus by the individual forming specific antibodies. These bodies, however, cannot be demonstrated in such advanced age segments of maturity or in senility in a sufficient percentage of incidence as to explain the decrease in the likelihood of infantile paralysis appearing in such periods of the life span. In reasoning of a reverse order, in the influenza epidemic of 1917 infants and young children were relatively notably spared the development of this virus disease, while adults who chronologically had



been afforded the time factor in which to acquire, by mild infections, an immunity of an extracellular chemical order were especially susceptible to it; and in this age segment of adulthood the mortality percentage rose to its height, again declining in the senescent and senile age groups.

The same order of inquiry applies to malignant disease (4). If such tissue developments have as their exciting cause the action of specific viruses, why is it that such bodies find in the cells, especially of certain organs as they pass their peak of maturity and into senescence, a favorable environment for their existence and express such an adaptation in a wildness of cell growth and an associated intoxication of the organism as a whole, designated as malignant disease? The occurrence of such states in infancy and early childhood and in senility is less frequent than in the mature and senescent individual. If such tissue growths come about from a lack of chemical tissue restraint or the advent of a tissue stimulus other than a living invading organism, it would appear equally important that knowledge of a highly complex, difficult-to-obtain, and exact order should be searched for in tissues at various age segments in order to explain modifications in tissue susceptibility or resistance to the development of such states of malignancy. Such states favorable to virus growth, to a lack of tissue restraint, or to tissue stimulation cannot be ascertained until we possess biochemical and biophysical information of cell life at various periods in the life of the organism as a whole, in order to contrast chemically through these data periods in the life span of tissues characterized by relative resistance as susceptibility to changes of a malignant order.

At the present time diseases of the heart and blood vessels, especially the latter, take the highest toll of life. Such terminal events, in all likelihood commencing years before the finality of the blood vessel accident or episode, certainly show themselves in a much higher percentage in adult and late adult life. The occurrence of coronary artery disease with occlusion in youth has recently been emphasized (1, 2). These heart and blood vessels changes are usually seen as tissue changes in the process of repair, as indicated by the laying down of fibrous tissue in the place of a protective endothelium and functional muscle

tissue. The familial incidence and, of more significance, the age incidence in the development of such disease cannot be questioned. Basic research of a chemical order in an attempt to learn the nature of those chemical changes, the modifications in blood vessel tissue metabolism, and tissue metabolism in general, in which such vessels that are associated with aging share, has certainly lagged in its applied interest. The older microscopic type of investigation, perhaps for want of an adequate chemical technique, continues to dominate investigations concerning the causes of heart and blood vessel disease. This most important problem will be solved only with the discovery of the biochemical constitution of tissues as they advance from an age period of relative nonsusceptibility to vascular disease into that middle-age segment in which their susceptibility is marked and at which time such changes often terminate life. As a result of the rapidly increasing life span of the individual there will be a mounting number of human beings falling in that age segment in which vascular disease reaches such a state of development as to express itself either as incapacity or death.

Through certain illustrations used above, an attempt has been made to divest the minds of many individuals of an interpretation of the study of aging processes as a dominant interest in senility. Senility and the care of the senile deserve consideration both as biological end reactions and as an expression of the fineness of human feeling. The significance of an understanding of aging resides in the assumption that through such information the shifting, adapting, and nonadapting changes of a chemical order of life are to express themselves in determining those age areas in which tissue degenerations make their appearance, in which tissues exert their influence in the formation of new and abnormal tissue growths, or the advent of certain specific states of disease falling in the group of viruses which require an intracellular environment highly specific in its chemical constitution for their propagation.

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#### Scanning Science—

From notices in the daily papers it appears that the registration at several universities is as follows: Yale, 2,515, an increase of 100 over last year; Columbia, 1,760, an increase of 130; Cornell, 1,720, an increase of 109; Chicago, 1,126, an increase of 17; Massachusetts Institute of Technology, 1,184, an increase of 12.

—30 October 1896



# Studies of Vitamin Deficiency<sup>1</sup>

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**B**IOCHEMICAL, CLINICAL, neurological, and psychological investigations were conducted on the subjects of this study who were patients in the Elgin State Hospital. The experimental design was such that the effects of diets restricted in their contents of thiamine and riboflavin for three full years could be continuously observed. A special building housed the patients, and very satisfactory facilities were provided for continuous supervision and rigid control of diets. All food was prepared in a diet kitchen adequately staffed with full-time workers. The diets were analyzed frequently, and the service was so arranged that the subjects of separate groups were served separately. Care was taken that the patients were not harmed by the diets or the study. The more important observations are reported here in brief. A full report is contemplated later.

Thirty-six male patients were selected from the State Hospital population. The need for persons who would be in continued residence for a prolonged period of time influenced the selection. The subjects were divided into two main groups: (1) patients whose ages ranged from 58 to 78 years and (2) younger patients who were from 24 to 42 years of age. Each of these groups was divided into three subgroups, designated as Groups A, B, and C, respectively. At the beginning of the project there were three groups of seven old men and three groups of five young men. Each person in the A groups received a daily diet containing approximately 2,200 calories, which was apparently adequate in all the essentials except thiamine, of which approximately 400 µg. were present, and riboflavin, of which the diet contained about 900 µg. Those in the B groups received the same diet except that a daily supplement of yeast extract was given which contained approximately 6 mg. of thiamine and 1.3 mg. of riboflavin. The members of the C groups received the regular hospital diet which they ate *ad lib*.

The clinical effect of this moderate restriction of thiamine and riboflavin on subjects of the A groups was at no time more than minimal. Noticeable, however, in these subjects, young and old, was a gradually increasing self-imposed restriction of activity, a dulling of interest and of ambition, a diminished desire to please, and a lessened tendency to bantering and playfulness. The statement applies to the general behavior of the subjects when left alone. Attempts to measure these changes of behavior by psychological

tests were thwarted to a large extent by compensations effected when the subjects were confronted by the conditions of the tests. The skin of several subjects of the younger group became thinner and lost elasticity, these changes imparting an appearance of ageing. The lips showed drying, thinning, and increased wrinkling. A more objective abnormality, noted within nine months from the beginning of the diet and persisting for more than two years, was an unusual elevation in the levels of lactic and pyruvic acids in blood obtained under standardized conditions of exercise and glucose load. Some abnormality in the levels of lactic and pyruvic acids in the blood occurred within the first three months.

At the beginning of the third year of the study the subjects of both B groups, whose diets previously had been supplemented with a yeast extract, were placed on a diet which was more rigidly restricted in content of thiamine and riboflavin than the diets of the subjects of the A groups. This provided 200 µg. of thiamine and 800 µg. of riboflavin. Among the subsequent observations on these subjects were the following:

(1) The levels of lactic and pyruvic acids in the blood were elevated under the standardized condition of exercise and glucose load. The standardized condition referred to consisted of climbing of stairs 60 minutes after ingestion of 1.8 grams of glucose/kg. of body weight. The concentration of lactic and pyruvic acids in the blood was increased more than in the subjects of the A groups, whose intake of thiamine was moderately restricted. This became apparent about three months after the diet of 200 µg. of thiamine was started and was followed shortly by the development of clear-cut clinical evidence of thiamine deficiency.

(2) Effects on the circulation, nervous system, and gastrointestinal tract were acute to subacute in onset. Among the circulatory effects was a nonpitting swelling of the facial skin, especially of the eyelids, which could be observed in subjects who did not develop pitting edema of the lower extremities. Budding of the blood vessels into the cornea with plexus formation in its periphery also was observed in a few subjects. Mental changes were characterized chiefly by loss of inhibitory control and a tendency to interpret distressing somatic changes in a paranoid fashion.

(3) A diagnostic tool which proved useful was an apparatus designed to study vibration sense. This apparatus made it possible to apply various frequencies to the external malleolus and the soft part of the big toe. The amplitude of the vibration was kept constant. The vibration sense in the lower extremities decreased markedly as the nutritional deficiency progressed.

(4) Psychologically, the patients on the more deficient diets (200 µg. of thiamine/day) manifested exaggera-

<sup>1</sup> Sponsored by the Committee on Nutritional Aspects of Ageing, Food and Nutrition Board, National Research Council. The project was supported by the Josiah Macy, Jr. Foundation and the Milbank Memorial Fund.

tions of their psychotic complaints and showed distinct changes in attitudes toward their environment.

(5) Marked individual differences in response to the diets were observed in both old and young groups, not only in time of onset of symptoms but also in the degree of resulting abnormality. The subjects who gave evidence of vitamin deficiency early manifested abnormalities which were greater in degree than those observed in others who were affected more slowly. Especially was this true with respect to the cardiovascular system. In general, the older persons were affected earlier and more severely than were the younger.

Recovery when yeast extract providing 6 mg. of supplementary thiamine was added to the diet was dramatic, especially in the subjective fields of appetite, general feeling tone, pain, and paresthesia. The levels of lactic and pyruvic acids after the standardized conditions of exercise and glucose rapidly returned to their predeficiency levels. Likewise, patellar reflexes which had been lost commenced to return soon after the yeast extract was added to the diet. On the other hand, return of the Achilles tendon reflex was very slow.

## Technical Papers

### Distribution of Sodium and Water in Muscle Following Severe Cold Injury<sup>1</sup>

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In a recent investigation of experimental cold injury (frostbite) it became evident that the physiological and chemical changes occurring in the injured regions after thawing resembled those found after severe injury produced by other means. The similarity in the natural history of the pathological processes in burns and frostbite has already been noted by Harkins (5). Our complete data, to be published later, demonstrate further points of similarity. We wish here to report the distribution of sodium and water in normal muscle and in muscle removed from rabbits' legs subjected to severe cold injury.

Six rabbits were anesthetized with dial, the hair removed from one hind limb as far as the lower end of the femur, and the leg immersed for 3 minutes in a water-alcohol-ethylene glycol mixture cooled to  $-55^{\circ}\text{C}$ . Blood samples from the marginal ear vein and muscle samples from the tibialis anticus of the normal and injured leg were taken 166 to 255 minutes after injury. Determinations of water and sodium by the method of Butler and Tuthill (1), as modified by Consolazio and Dill (2), were made on samples of plasma and muscle.

The results of the analyses and derived values obtained by the method of Harrison, Darrow, and Yan-net (6) are presented in Table 1. Since the experiments involved comparisons between muscles in the

same animal and since only brief intervals were allowed to elapse between injury and sampling, it was considered to be unnecessary to determine and correct for fat content of the muscle.

TABLE 1  
CHANGES IN WATER AND SODIUM IN TIBIALIS ANTICUS  
MUSCLES AND PLASMA OF RABBITS AFTER  
IMMERSION-FREEZING

Animal Nos.	31	64	66	67	75	80
Plasma						
[Na] <sup>+</sup> m. eq./l. plasma ultrafil- trate .....	138.1		145.8		141.9	
Control Muscle						
Total H <sub>2</sub> O* .....	313.5	321.2	318.0	315.0	328.5	360.0
Total Na† .....	7.56	7.32	6.76	7.44	8.26	8.58
Extracellular H <sub>2</sub> O .....	54.7		46.4		53.2	
Frostbitten Muscle						
Total H <sub>2</sub> O .....	328.5	399.0	440.0	507.0	500.0	530.0
Total Na .....	9.84	24.65	34.63	40.05	53.90	68.40
Extracellular H <sub>2</sub> O .....	71.2		237.4		380.0	
Gain of water (%) ..	4.8	24.4	38.4	61.0	52.4	47.2
Gain of sodium (%) ..	30.2	237.0	412.3	438.0	553.0	697.2

\* H<sub>2</sub>O expressed in grams/100 grams dry tissue.  
† Na expressed in m. eq./100 grams dry tissue.

The data show that the gain of water by muscle following severe injury by cold ranged from 5 to 60 per cent, while the increase in sodium was proportionately much larger: 30 per cent in the case of the smallest increase and 237-697 per cent in the remaining five animals studied. Such large disproportion between the gain of water and that of sodium could occur only if large quantities of sodium penetrated the intracellular phase or in some other way became excluded from free equilibrium with the remainder of the sodium in the extracellular phase.

A fall in the level of serum sodium in man (8) and animals (7) after severe burns led Lowdon, *et al.* (7) to suggest that sodium was being lost into the injured tissues. Sodium in venous blood was found to be lower than in arterial blood, but tissue analyses were

<sup>1</sup> The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and Stanford University.



not reported. Fox and Keston (4) observed in mice injured by heat or by trauma that sodium accumulated in the injured tissues, and that the gain in sodium exceeded the gain in water. In rats, both hemorrhagic shock and hepatic anoxia, induced by occlusion of the hepatic artery, were accompanied by increase in liver sodium (3).

The results reported here, together with those obtained after the various other types of injury mentioned above, suggest that redistribution of sodium is a nonspecific event which follows severe tissue injury, regardless of the means by which the injury was produced.

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### Mechanism of Hyaluronidase Action in Skin<sup>1</sup>

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The mechanism whereby spreading factors (S.F.) from bacteria, testis, venoms, etc. increase the permeability of skin remained obscure until Chain and Guthrie (1) suggested that S.F. are enzymes (hyaluronidases) which lower the viscosity of the mucoid ground substance of the connective tissues (hyaluronic acid). This enzymatic theory has been supported and extended by some workers, but the explanation of the entire mechanism of spreading on the basis of the hyaluronidase activity of S.F. has met with opposition (cf. the review of Duran-Reynals, 2). It is the purpose of this report to point out that the spreading produced by hyaluronidase is not only dependent upon enzyme concentration but is also directly related to the increase of interstitial pressure produced by the injected fluid.

Spreading in shaved rabbit abdominal skin was measured using methemoglobin (obtained from twice-crystallized bovine hemoglobin) as indicator. It was observed that the induction of spreading by purified bovine testis hyaluronidase<sup>2</sup> is limited to the

first 10 minutes following intradermal injection, and that thereafter the rates of spreading in hyaluronidase-treated and control areas are identical. Table 1

TABLE 1

Enzyme concentration ( $\mu\text{g./cc.}$ )	Area increase over control at 10 min. ( $\text{cm.}^2$ )
0.16	0.24
0.33	0.62
0.67	0.96
1.33	2.28
1.67	2.42
6.67	3.56
33.33	3.49
66.67	3.60

shows the effect of hyaluronidase concentration (administered intradermally in a constant volume of 0.2 cc.) upon the increase in the area of spread after 10 minutes. It will be seen that there is a quantitative relationship between enzyme concentration and spreading in the low-dosage range. With higher doses, maximal effects are obtained with a particular enzyme concentration, so that increasing the enzyme concentration 10 times does not demonstrably increase the spread. This lack of correspondence between high dosages and spread has been noted previously (3) and has been ascribed to the presence in skin of an active mechanism for S.F. inactivation. Search for such a possible mechanism was undertaken along the following lines:

(a) *Inhibitor in skin*: *in vitro* incubation of hyaluronidase with extracts of whole skin or dermis; or the insoluble residues from these extracts; or skin or dermal breis.

(b) *Inhibitor formed during the reaction between enzyme and hyaluronic acid*: *in vitro* incubation of hyaluronidase with hyaluronic acid from umbilical cord at pH 7.0.

(c) *Inhibitor in blood*: comparison of hyaluronidase spreading activity in normal, hyperemic (xylol), ischemic (hemorrhagic shock), and dead skin.

Evidence for hyaluronidase inhibition sufficient to account for the lack of correspondence between high doses and spreading was not obtainable from the experiments listed in (a), (b), or (c).

These negative findings, coupled with an observed quantitative correspondence of hyaluronidase action in living and dead skin, suggested that the S.F. effect might be due in part to simple mechanical action. The question arose as to whether hyaluronidase might simply reduce the resistance of skin to fluid passage. However, this effect could be evident only when accompanied by a localized increase of interstitial pressure and volume in the skin. On this basis, once the bleb injected with maximal amounts of hyaluronidase had spread (and had correspondingly decreased the interstitial pressure), the presence or absence of ex-

<sup>1</sup> Aided by a grant from G. D. Searle and Company.

<sup>2</sup> Obtained through the courtesy of E. Schwenk, of the Schering Corporation. The preparation used was purified by the method of Madinaveitia (4).

cess hyaluronidase should have no further significance.

To test this hypothesis, highly concentrated hyaluronidase solutions (3.3–333  $\mu\text{g./cc.}$ ) plus indicator were placed on superficial epidermal incisions for as long as 90 minutes and their spread compared to indicator solutions not containing the enzyme. No significant spreading effect of hyaluronidase was evident in these experiments wherein fluid was administered under zero pressure. In the next experiments, varying skin interstitial pressures were obtained by varying the volume of hyaluronidase administered intradermally (the enzyme concentration, 3.33  $\mu\text{g./cc.}$ , was kept constant).

Table 2 shows these results. The value "T" is calculated from  $T = \text{volume administered/area spread}$

TABLE 2

Vol. ( $\text{cm.}^3$ )	Initial T (mm.)	Initial rate ( $\text{cm.}^2/\text{min.}$ )	Area increase over control at 10 min. ( $\text{cm.}^2$ )	T at 10 min. (mm.)
1.0	3.3	7.41	9.86	0.64
0.5	3.2	6.95	8.37	0.43
0.25	1.9	3.26	3.06	0.45
0.10	1.3	1.39	1.01	0.38

(assuming that there is neither gain nor loss of fluid from the injected fluid volume). "T" is thus an index of the average "thickness" of the injected bleb and is regarded as a value proportional to the increased interstitial pressure produced by intradermal fluid administration. Table 2 demonstrates that:

(1) The initial rate and final areas of spread of hyaluronidase solutions are directly related to volume from 0.1 to 0.5 cc. and thereafter level off.

(2) The initial rate is directly proportional to "T," the thickness of the bleb at that time.

(3) The "T" values at 10 minutes, independent of the volume injected and initial "T" values, are approximately the same.

TABLE 3

Vol. ( $\text{cm.}^3$ )	Enzyme concentration ( $\mu\text{g./cc.}$ )	Initial rate ( $\text{cm.}^2/\text{min.}$ )	Area increase over control at 10 min. ( $\text{cm.}^2$ )
0.25	13.4	2.97	3.04
0.10	33.3	1.53	1.03

Another experiment, the results of which are shown in Table 3, answers possible objections that the results in Table 2 are due to differences in the total amounts of hyaluronidase administered. Here the total amounts of enzyme were kept constant (3.3  $\mu\text{g.}$ ), but the volumes were varied. As will be seen, the solution administered in largest volume (but lowest concentra-

tion) spread to a greater extent than did the solution injected in smaller volume and highest concentration.

The finding that hyaluronidase induces spreading only when local interstitial pressure is increased by fluid administration, coupled with the demonstrated correspondence between spreading and interstitial pressure-volume relationships, helps to elucidate many obscure points of S.F. action. Space does not permit adequate treatment of this material, which will be discussed in subsequent reports. However, the significance of these findings as regards the relation of S.F. to bacterial invasiveness through skin might briefly be mentioned. Bacteria usually penetrate the skin through abrasions with only minimal amounts of fluid accompanying the invading organism. Thus, the spread of organisms through the interstitial spaces will depend as much upon the ability of the bacteria to stimulate the production of edema-inducing "leukotaxin-like" substances (5) as it does upon S.F. production.

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### Grafts of Free Muscle Transplants Upon the Myocardium

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Within recent years the introduction of nerve-muscle transplants and pedicle-muscle grafts has made possible remarkable advances in many branches of clinical surgery. It is now becoming feasible to replace necrotized and nonfunctioning tissue destroyed by trauma and infection with free muscle grafts.

Experiments of Beck (1) and O'Shaughnessy (2) have demonstrated that pedicle-muscle grafts onto the heart resulted in the creation of a significant vascular anastomosis between the two tissues, particularly in the myocardium were rendered ischemic. Such grafts not only brought extra cardiac blood to the heart but also served as an anastomotic channel for the transport of blood between healthy and diseased coronary beds. Although this method gave great experimental promise, the clinical application of large pedicle muscle grafts was necessarily limited because of the extensive surgical manipulation involved in its adaptation to human cardiac surgery. Therefore, simpler methods obviating past difficulties have been sought



In 1933 Leriche and Fontaine (3) foresaw the value of free muscle grafts for the replacement of myocardial infarcts. However, their work was very limited and was never taken up by others.

Basic studies on the regeneration and reconstitution of free muscle grafts are indicative of the applicability of this method to clinical surgery. The regeneration of small sections of mammalian striped muscle grafted in situ and/or transplanted at right angles to its original orientation was studied by LeGros Clark (2). Reconstitution of muscle was manifested by fine plasmodial outgrowths from the ends of the surrounding muscle and by sarcoplasmic buds from the muscle graft. The initial fibroblastic union between recipient muscle and the donor graft was replaced rapidly by young muscle fibers crossing in parallel formation into the graft. The directional pathway was determined by the structure of the degenerating transplant rather than the course of the original muscle fibers. After 18 days the majority of new muscle fibers had penetrated the graft. Thereafter, maturation was rapid, and the usual skeletal striations were present histologically. These experimental studies have provided evidence in support of the practicability of the transplantation of free muscle grafts.

The present investigation consisted of an attempt to graft free skeletal muscle onto the intact myocardium of dogs. Nine dogs of variable age, and ranging in weight from 10 to 17 kg., were used. The animals were anesthetized by intravenous injections of sodium pentobarbital. Positive pressure in the lungs was maintained when the thoracic cage was opened. The muscle graft, rectangular in shape and averaging 7×4 cm., was obtained from the anterior abdominal wall (internal oblique) or from the lower extremity (vastus lateralis). It was placed around the heart and anchored thereto by means of three or four fine cotton sutures. The epicardial surface of the heart was not scarified. The pericardium was sutured over the graft, the latter being usually included in the suture line. The Emerson respirator proved a valuable adjunct in re-establishing voluntary respirations immediately following the operation.

Except in the infected cases, the postoperative course of the dogs was accompanied neither by shock nor by severe disability, and within two or three days they were up and about in their kennels. After recovery, the dogs were exercised daily. The animals showed no signs of cardiac incompetency or depletion of cardiac reserve. After a period of 10 to 15 weeks the animals were anesthetized and the cardiac transplants examined.

In this series of nine dogs, six animals were sacrificed and the other three preserved for special studies. In the former group two completely success-

ful muscle-graft "takes" were found, while in a third, islands of regenerating muscle were present. In the other three dogs there was total absorption of the muscular elements of the graft with replacement by a connective tissue layer not unlike that of fascia. Signs of intrapleural, pulmonary, and pericardial infection were evident in these cases. The three dogs still alive have shown no signs of postoperative infection. One of them was reoperated upon after 15 weeks, and a branch of the left coronary artery was ligated. Upon opening the pericardium the graft was found to have taken completely.

Examination of the dogs with the free muscle-graft "takes" revealed several significant facts. The grafts were well fixed to the myocardium with little or no mobility. The transplant was easily identified over the ventricle and showed practically no shrinkage. However, the skeletal muscle graft had lost its reddish color and, on section, appeared tan-yellow with white trabeculae of connective tissue. Between the graft and myocardium the epicardium was thicker than normal with a rich vascular network. Sections taken through the graft showed a normal muscle histology with no histopathological variations in either the nuclei or the muscular components. The usual cross striations characteristic of skeletal muscle were present. On examination of the heart with the thoracic cage open, no deleterious effect on cardiac function and blood circulation from the standpoint of cardiac dilatation, extrapericardial adhesions, or intrapericardial pressure was observed.

Sufficient evidence has been accumulated from these experiments to state that free muscle transplants may successfully be grafted upon the myocardium of the dog's heart.

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### Effect of Penicillin on Seed Germination

WALTON J. SMITH<sup>1</sup>

*Chas. Pfizer & Company, Inc., Brooklyn, New York*

Many clinical and biochemical differences have been reported between pure, crystalline penicillins and the crude, yellow grade of therapeutic penicillin used for clinical purposes. Lewis (2) reported a growth inhibition toward cancer tissues of therapeutic penicillin, but purified penicillin showed no such inhibition. It was hoped that seed germination tests could be used to measure this anticarcinogenic activity. Work done

<sup>1</sup>The author wishes to express his appreciation to Dr. George S. Avery, Jr., of the Brooklyn Botanic Garden, for his valuable advice in connection with this work.

by the author over a year and a half ago showed that while therapeutic penicillin inhibited seed germination, crystalline sodium penicillin G had little such effect. This antigermination activity was shown to be due to aromatic acids of the indole-3-acetic acid type, which are commonly present in crude penicillin preparations.

The work recently reported by Ribeiro (3), in which penicillin was found to be exceedingly active in inhibiting germination, suggested that impure penicillin was used. The author did not describe the nature of the penicillin used.

In the present study of sodium penicillins G, K, and dihydro F (constituents of commercial penicillin), all were found to be relatively inactive in inhibiting germination of radish seeds. Streptomycin sulfate, whether purified or crude, was also relatively inactive when treated in the same way.

Phenylacetic acid, indoleacetic acid, and furoic acid had been found in all lots of the therapeutic preparation tested and were therefore tested separately for antigermination activity. Each of the three substances was active against germinating seeds; however, most of the inhibiting property of therapeutic penicillin could be accounted for by the indole-3-acetic acid present. At concentrations at which the other substances permitted nearly normal elongation, indole-3-acetic acid permitted only 7 per cent of the normal root elongation in germinating wheat seeds (4). Analysis of the particular lot of therapeutic penicillin used for the germination tests (Pfizer lot 755) by the method of Holt and Callow (1) showed 2.1 per cent indoleacetic acid.

The germination tests were made in 90-mm. Petri dishes, the seeds being placed on filter paper dampened with 5 ml. of solution. They were allowed to germinate for several days in the dark, after which time the percentage of germination was observed. A more quantitative measurement of growth was the length of the shoots and roots of the germinated seeds.

The penicillins used were extensively purified<sup>2</sup> by means of silica gel chromatographs saturated with phosphate buffers. They were further purified by recrystallization.

Most of the experiments were carried out with radish seeds (var. Sparkler), but similar results were observed with spring wheat when therapeutic penicillin was compared with crystalline sodium penicillin G. Therapeutic penicillin and indole-3-acetic acid have been tested with many different kinds of seeds and found inhibitory to all.

<sup>2</sup> The purified antibiotics were made available through the courtesy of Dr. R. Pasternack; the penicillins were purified by Dr. V. Bogert, and the streptomycin by Mr. I. A. Solomons, all of Chas. Pfizer & Company.

Since therapeutic penicillin was inhibitory to about the same degree reported for "penicillin" by Ribeiro against lettuce, it may be concluded that Ribeiro actually used therapeutic penicillin for his tests and that his findings were not due simply to the use of a different variety of seed.

The nature of the stunted growth of roots caused by the impurities in therapeutic penicillin and by the aromatic acids was very similar. Instead of normal root elongation, there was a marked enlargement of the hypocotyl. Sunflower seed from which the seed coat was removed was affected similarly; in addition, the cotyledons were curled away from one another. The cucumber behaved similarly. Of the seeds tested, cabbage was the most sensitive to indoleacetic acid.

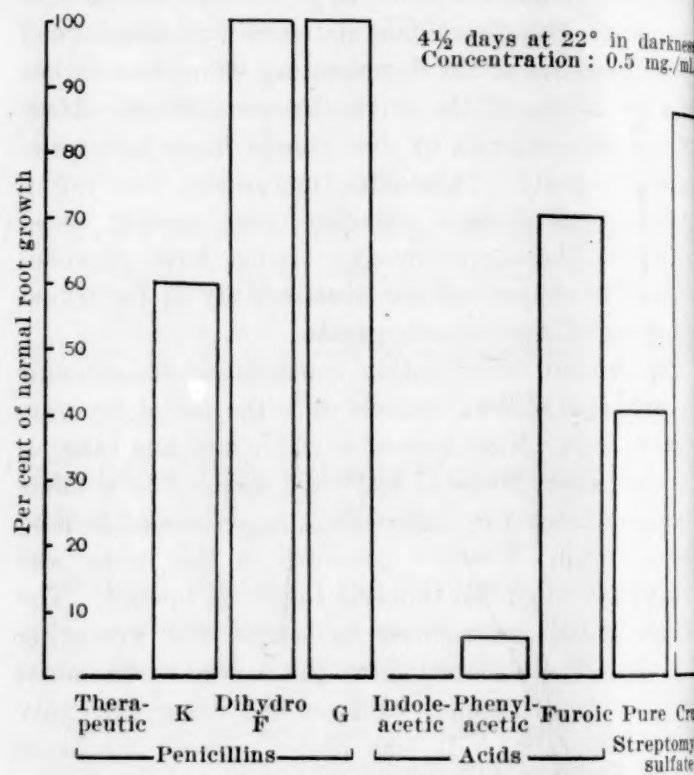


FIG. 1. Germination tests on radish seeds.

The accompanying chart (Fig. 1) illustrates the comparison of the action on seeds at one concentration of each of the substances tested. The data included in the chart are representative of those at other concentrations.

Data on streptomycin in pure and crude form have been included for comparison. The rather low toxicity of streptomycin and penicillins to seed germination and growth suggests their possible use in antiseptics for seed treatment and plant sprays.

**Summary.** The substances present in therapeutic penicillin which cause inhibition of germination and root growth are represented by the indole-3-acetic acid type of compound. Since this and phenylacetic acid were known to be present in the penicillin tested, it is concluded that they are responsible for the inhibition activity against seeds.



None of the crystalline penicillins tested appreciably retarded germination.

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### A New *Helminthosporium* Blight of Oats<sup>1</sup>

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Botany and Plant Pathology Section  
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H. C. MURPHY

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A new *Helminthosporium* disease affecting mainly oat varieties and selections possessing the Victoria-type resistance to crown rust has become widespread in most oat-growing regions of the United States (1, 2). Although the first isolation from oats was made in November 1944, the organism was previously isolated from timothy seed. Numerous field isolations were obtained in 1945, and in the 1946 oat season infection was so severe in many areas as to cause serious reduction in yields. The fungus is known to have been present in 19 states in 1946, from Texas to New York and from Florida to Idaho.

Plants infected in the seedling stage were characterized by necrosis of the basal portions, and striping or reddening of the leaves, progressing upward from the lower leaves. The same symptoms were evident on plants in later stages of maturity, but the basal stem- and root-rot became the primary factors in identifying the disease, since striping and discoloration of leaves may be due to a number of causes. The leaf striping is believed to be a secondary toxic effect of basal infection. Mature plants in the field were blackened at the nodes with abundant sporulation of the fungus, and the lower internodes showed a characteristic brownish translucence. Culms weakened by severe infection broke over near the ground line and at the lower nodes, and excessive lodging made harvesting of many fields difficult.

The species of *Helminthosporium* responsible for this destructive disease of oats resembles three other members of the genus in several respects: *H. setariae* Sawada, *H. sacchari* Butler, and *H. sativum* Pam. King and Bakke. These similarities will be discussed in detail in a subsequent paper. Since, however, no

description of a species of *Helminthosporium* which corresponds satisfactorily to this species has been found in the literature, it is proposed that it be recognized as a new species under the name *Helminthosporium victoriae*. This specific name is suggested because of the potential importance of this parasite as the cause of a foot-rot and leaf-stripe disease of oat varieties and selections possessing the Victoria resistance to crown rust (*Puccinia coronata avenae* (Corda) Eriks. & E. Henn.).

#### HELMINTHOSPORIUM VICTORIAE SP. NOV.

Conidiophoris erectis, simplicibus, pallide olivaceis usque brunneis, 60–280 × 5.8–10 μ, 4–10 septatis, apicibus geniculatis 30–80 μ; conidiis pallide olivaceis subcurvatis, elongato-ellipsoideis parte superiori plerumque angustiori, hilis aliquantulus protrudentibus, 40–130(70) × 11–25(15) μ, 4–11(8) septatis, muris modice tenuibus, tubulo uno e quaque cellula terminali germinantibus.

Hab.—In radicibus et culmis *Avenae sativae* L. (typus) et *A. byzantinae* C. Koch et hybridis inter eas parasiticus; et in plantis variis saprophyticus vel leniter parasiticus.

Conidiophores form velvety growth on lower nodes and sparse fructifications on basal leaf sheaths of mature oat plants. Conidiophores are erect, simple, emerging usually singly or occasionally in clusters of 2 to 5 from stomata or from between epidermal cells of infected culms, and measure 60–280 μ in length × 5.8–10 μ in width with 4–10 septa, mostly 120–160 μ × 6.5–7.8 μ with 6–8 septa; they are light olivaceous to medium brown and have a rather closely geniculated apical spore-producing area, 30–80 μ in length.

Conidia are fuliginous to dark olivaceous but typically light olivaceous, slightly curved, rounded at the base, widest near the center, and tapering to a rounded tip. Normal conidia measure 40–130(70) μ × 11–25(15) μ with 4–11(8) septa, have moderately thin walls, and germinate by one polar germ tube from each terminal cell, the basal germ tube emerging adjacent to the slightly protruding hilum. Conidia produced on water agar approach normality but are somewhat smaller and have fewer septa. Weathered spores at bases of mature plants in the field frequently are atypical, dark brown, irregular in shape, and with thick exospore. Typical cultures form a light- to medium-gray tufted colony on oat agar. One saltant, a profusely sporulating strain, produces a dark greenish-black colony.

The fungus is evident chiefly on the basal portions of *A. sativa* L. and *A. byzantina* C. Koch and hybrids between them, producing necrosis of roots and lower stem parts. On immature plants, it causes reddish-

<sup>1</sup> Journal Paper No. J-1396 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project No. 72: cooperative investigation between the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture, and the Botany and Plant Pathology Section of the Iowa Agricultural Experiment Station.

brown longitudinal foliar stripes and withering of leaves. It occurs also as a saprophyte or weak parasite on *Phleum pratense* L., *Dactylis glomerata* L., *Sorghum vulgare* Pers., *Agropyron cristatum* (L.) Gaertn., *Setaria viridis* (L.) Beauv., *Hordeum vulgare* L., *Paspalum notatum* Flügge, *Chloris Gayana* Kunth, and *Soja Max* (L.) Piper. It has been isolated from oats grown in 19 states, from Idaho to Texas eastward, in 1945 and 1946, and from the other-named hosts in and around Ames, Iowa, from 1942 to 1946. A collection of *A. sativa* var. Boone, made by the senior author at the Agronomy Farm, Iowa Agricultural Experiment Station, Ames, on 25 July 1946 is designated as the type (U. S. Department of Agriculture, Mycological Collections No. 71483). Portions of the type collection have been deposited in the Mycological Collections of the Bureau of Plant Industry, Beltsville, Maryland; in the herbarium of the Botany Department, Iowa State College, Ames; and in the Farlow Herbarium, Harvard University, Cambridge, Massachusetts.

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### Maintenance of Penicillin Blood Levels After a Single Intramuscular Injection of Penicillin in Various Oils

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This is a preliminary report on a study being made to determine the most satisfactory diluent for penicillin from the standpoint of maintaining a blood level of 0.1 unit/ml. over a period of 24 hours after a single intramuscular injection.

The diluents tested were peanut oil, cottonseed oil, soybean oil, hydrogenated peanut oils (melting points, 40° C. and 50° C.), hydrogenated soybean oil (melting point, 40° C.), and a commercially prepared mixture in which the penicillin was suspended in peanut oil and 4.8 per cent beeswax<sup>1</sup> from two pharmaceutical companies. The penicillin was mixed with each diluent in the amount of 300,000 units/ml. The doses injected were 300,000 units (1 ml.), 1,000,000 units (3.3 ml.), 1,500,000 units (5 ml.), and 2,000,000 units (6.7 ml.), the majority of doses being 1,000,000 units. So far, 254 injections of penicillin in various oils have been

given to 36 ambulatory patients, all but two of whom were syphilitics.

Penicillin blood levels have been determined by the Hobby method (2) and checked by a modification of the Kirby-Rantz method (3). The streptococcal inhibiting factor in human sera, as described by Eliasson (1), was tested for in some 10 patients, and of all the specimens assayed, none showed a streptococcal inhibiting factor.

It should be emphasized that there has been a remarkable variability in blood levels taken at stated times from different patients receiving the same dose at the same intervals. This variability has been noted by other workers in similar studies.

In cases treated to date we can state that hydrogenated oils delayed the absorption of penicillin more than the plain oils.

A prolonged high level was observed most frequently after the use of either hydrogenated cottonseed oil (melting point, 40° C.) or the penicillin-beeswax-peanut oil mixture when tested following a 300,000-unit or a 1,000,000-unit dose of penicillin.

A dose of 300,000 units of penicillin in hydrogenated cottonseed oil maintained a 0.1 unit/ml. penicillin level for at least 6 hours in about 80 per cent of the cases, while in the beeswax-peanut oil mixture it maintained that level in 66 per cent of the cases. Twelve hours after injection of 300,000 units in hydrogenated cottonseed oil only about 16 per cent of the cases had a 0.1 unit/ml. penicillin level, while the beeswax-peanut oil mixture had no 0.1 unit/ml. levels. In a 1,000,000-unit dose these two preparations gave a 24-hour penicillin blood level of at least 0.1 unit/ml. in 38 and 40 per cent of the cases, respectively, as well as producing higher penicillin blood levels at the 6- and 12-hour intervals after injection. In general, our results from either of these preparations have been very similar, although from our experience with the extemporaneous preparation of a suspension of penicillin in hydrogenated cottonseed oil it has seemed to have a practical advantage over the penicillin-beeswax-peanut oil mixture in that it melted considerably more rapidly under a hot-water tap, was less viscous at any given temperature, and stayed liquid longer after having been heated.

At this early date we can make no statement regarding the therapeutic value of daily injections of either preparation in the treatment of syphilis, except to say that the serological results so far have been encouraging. The follow-up period has been sufficiently long for 6 out of 19 seropositive primary and secondary syphilitics to have given negative serological tests in an average of 60 days.

**Summary.** Experiments with various oily diluents for penicillin indicated that of the oils tested, peanut oil with 4.8 per cent beeswax, and hydrogenated cot-

<sup>1</sup> As advocated by Romansky and Rittman (*Science*, 1944, **100**, 196).



cottonseed oil (melting point, 40° C.), produced the most satisfactory prolongation of the absorption of intramuscularly injected penicillin.

Increasing the dosage of the individual injection not only heightened the penicillin blood levels at any given hour after the injection but also increased the duration of the retention of penicillin in the blood.

It seems probable that a dosage of 1,500,000 units of a very finely ground calcium penicillin of high potency suspended in hydrogenated cottonseed oil (melting point, 40° C.), which can be made fluid under a hot-water tap and dispersed in a disposable syringe, would maintain a penicillin blood level of 0.1 unit/ml. for 24 hours or longer in nearly all cases.

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#### The Chloride Content of Conifers

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According to two widely used textbooks (1, 6), the element, chlorine, is absent in coniferous plants. This erroneous statement apparently is based on a mistaken interpretation of the results of an extensive microchemical survey by Jung (5), who used the following reagents for the detection of chlorides in plant sections: (a) 0.5 gram of thallous acetate and 2 grams of glycerol in 7.5 grams of water; (b) 0.1 gram of silver nitrate in 9.9 grams of 10 per cent ammonia solution. The first reagent gave more characteristic crystals than the latter, but was much less sensitive to small amounts of chlorides. He examined qualitatively 604 species of plants from 389 genera, representing 137 families. In 5 of 18 species of conifers tested, chlorides were present in traces. Other species were consistently negative in their reaction, so that the conifers were included in a class of plants designated as "salt-shunning."

Thus, Jung's data on the chlorides of conifers contradict the textbook generalizations. In addition, the following quantitative chemical analyses show that many conifers contain chlorides:

Wolff's tabulations (9) show chloride analyses for *Pinus Laricio austriaca* (= *P. nigra austriaca*) and for *P. Abies* (*Abies excelsa*) (= *Picea Abies*). Robinson, Steinkoenig, and Miller (7) found the following percentages of chlorides (dry-weight basis): shortleaf

pine (*P. echinata*) needles, 0.11; stems, 0.05; longleaf pine (*P. palustris*) needles, 0.13; stem, 0.09. Harris and collaborators (2) measured the chloride content, reported as grams per liter, of the expressed saps of the following conifers: *P. flexilis*, 0.4; *Pseudotsuga mucronata* (= *P. taxifolia*), 0.7; *Juniperus utahensis*, 0.2-1.5. Wherry (8) has reported analyses for chlorides in the pitch pine (*P. rigida*). According to a personal communication, the greater part of the samples consisted of needles, with the inclusion of not more than 3-4 cm. of stem. A sample of pitch pine from a Coastal Plain woods in New Jersey contained 0.67 per cent chlorides in the ash, equivalent to 0.02 per cent fresh weight. The corresponding figures for a sample from a serpentine-barren soil in Pennsylvania were 1.44 and 0.03 per cent. Jessen (4) fertilized larch (*Larix europaea*), spruce (*Picea Abies*), and pine (*P. sylvestris*) plants with increasing amounts of KCl in one series and of K<sub>2</sub>SO<sub>4</sub> in another series. In sand cultures marked injury resulted as the chloride content of the fertilizer was increased; chloride injury was much less evident in the forest-soil series. No injury was noted in the K<sub>2</sub>SO<sub>4</sub> series except to one-year spruce transplants. To illustrate some of the figures for the chloride content (based on the dry weight of the whole plant) one-year-old unfertilized spruce trees (sand culture) contained 0.37 per cent Cl; fertilized with the maximum addition of KCl, the percentage increased to 2.09, as compared with a figure of 0.34 per cent Cl for the maximum addition of K<sub>2</sub>SO<sub>4</sub>. In limed forest-soil cultures, the chloride content of unfertilized spruce seedlings varied from 0.12 to 0.17 per cent; when the maximum amount of KCl was added, the chloride content increased to 0.36-0.38 per cent.

TABLE 1

CHLORIDE CONTENT OF HEALTHY SHORLEAF PINE NEEDLES AND OF NEEDLES IN DIFFERENT STAGES OF "LITTLE-LEAF" DISEASE

Needles	Per cent chlorides (dry weight)	Average chloride content per needle (μg.)	Average dry weight of needles (mg.)
Healthy .....	0.069 (40)*	16.4 (25)	22.5 (25)
Diseased .....	.119 (28)	11.3 (15)	11.6 (13)
Difference .....	.05	5.1	10.9
Standard error of difference	.0106	1.885	1.441
P .....	<0.001	~ 0.01	< 0.001

\* The numbers in parentheses represent the number of samples measured.

In connection with the problems of "little-leaf" disease in *P. echinata* (3), the present authors have analyzed 68 samples of needles for chlorides. These samples were collected from 15 different localities in six southern states. The needles were taken in 1942 from the middle of the crown of the trees from growth

made in 1941. The method of chloride determination was the second official volumetric method described on pages 135-136 in the "Official Methods" (10). Two-gram samples of previously dried needles were analyzed in duplicate. The average weight of needles was obtained by weighing samples of 100 needles to permit the calculation of the average absolute amount of chloride per needle.

The data, summarized in Table 1, show that the average percentage of chloride was higher in the samples of diseased needles, but that the corresponding absolute amount of chloride per needle was less in the diseased needles because of their smaller average weight. There appears to be no obvious connection

between the "little-leaf" disease in shortleaf pines and the chloride content of the needles.

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## News and Notes

### AAAS Meeting Notes

The American Microscopical Society will meet with the AAAS in Boston on 26-27 December 1946. The Executive Committee Luncheon will be held at 1:30 P.M. on 26 December at the Statler Hotel, in a room to be announced. The annual meeting of the Society will be called to order in the Hancock Room of the Statler at 4:00 P.M. on Friday, 27 December. Officers of the Society hope for a large attendance of members at this meeting, since certain amendments to the Constitution are to be voted upon at that time.

The Biometrics Section of the American Statistical Association will participate in the meetings of the AAAS, to be held in Boston, 26-31 December 1946. A symposium, sponsored by the Biometrics Section and the Atlantic Fishery Biologists, will be held on Friday morning, 27 December, to discuss the biometric aspects of fish populations. The Friday afternoon session, which will be held jointly with the Ecological Society of America, will deal with the use of mortality table techniques in studying biological populations. Two joint sessions with the Institute of Mathematical Statistics, scheduled for Saturday, will be devoted to a discussion of analysis of variance in biological problems. The Sunday program will consist of two sessions of contributed papers in which both members and nonmembers are invited to take part. Anyone wishing to contribute papers at these sessions should notify Dr. D. B. DeLury, Box 551, Blacksburg, Virginia.

Members wishing to be certain of hotel reservations for the Boston Meeting should make them early. A blank for this purpose will be found on page 9 of the Advertising Section in this issue.

### About People

Howard A. Meyerhoff, executive secretary of the AAAS, resigned on 30 October to become a member of a survey party interested in the minerals of the Argentinean Andes. Dr. Meyerhoff, who is on leave of absence as professor of geology from Smith College, expects to be in Argentina for the next six months. He is well known to *Science* readers through his analyses of the legislative situation surrounding the proposal for a National Science Foundation. Shortly before he left he was officially cited by the Board of Directors of the American Psychological Association for his good work in attaining a "realistic compromise."

Theodore Freiser, formerly with the Mellon Institute, was appointed instructor in analytical chemistry at the University of Pittsburgh beginning with the fall semester.

George A. Kelly, formerly of the University of Maryland, has been made professor of psychology at The Ohio State University.

Wayne G. Norton, Eastman Kodak Company, Rochester, received the Adolph Lomb medal from the Optical Society of America on 4 October at the Society's 31st annual meeting at the Pennsylvania Hotel, New York City. The award, made possible by a fund left by Adolph Lomb, treasurer of the Society from its founding until his death in 1932, is made annually "to a person under 30 years of age who shall have made a noteworthy contribution to optics." Mr. Norton, who is 27, was graduated from the University of Rochester in 1941 and has been employed by the Eastman Kodak Company since that time. During



the war he engaged in production engineering, research, design, and development of fire-control instruments, including the heightfinder and rangefinder, produced for the Army and Navy.

*L. van Dam*, of the Zoological Laboratory, Groningen, Holland, has written to Charles G. Wilber, Fordham University, concerning his internment in Japanese camps at Java during the war and the loss of his entire collection of books and reprints. Dr. van Dam returned to Holland only a few months ago and is anxious to receive reprints and surplus books in the field of physiology.

*Fred M. Bullard*, professor of geology at the University of Texas, taught courses in geology in the 1946 summer session of the National University of Mexico, Mexico City, for the fourth consecutive season. While in Mexico he continued his studies on the new volcano, Parícutín. Following the summer session, Dr. Bullard made a survey of the active volcanoes of Central America, especially in Guatemala, El Salvador, and Nicaragua, under the sponsorship of the University of Texas Research Institute.

*E. Ruffin Jones, Jr.*, formerly professor of biology, College of William and Mary, has been appointed associate professor of biology at the University of Florida.

*Gladys C. Schwesinger* has been appointed senior clinical psychologist with the State of California Youth Authority following her release from government service with the War Relocation Authority at Monzanar, California. Her new headquarters will be at Ventura, California.

*John O. Hutchens*, associate professor of physiology at the University of Chicago, has been appointed chairman of that Department. He will continue as director of the Toxicity Laboratory, of which George H. Mangun has been made associate director.

*Emil Heitz*, Basel, Switzerland, has been appointed visiting professor of botany, University of Missouri, effective 1 February 1947.

*Vernon W. Schaefer*, *Richard W. Husband*, and *George Seeck* have been appointed professor, associate professor, and assistant professor, respectively, in the Department of Psychology, Iowa State College, Ames.

*James P. Heath*, who was recently released from the Navy, where he served on epidemiological and research staffs, is to join the staff of the Department of Natural Sciences, San Jose State College.

*Churchill Eisenhart* has been made principal mathematician directly in charge of the statistical work of the National Bureau of Standards, according to E. U. Condon, director of the Bureau. Dr. Eisenhart is on

leave of absence during the academic year 1946-47 from the University of Wisconsin, where he is associate professor of mathematics.

*Thurlo Bates Thomas*, University of Texas, has been appointed professor and chairman of the reorganized Department of Zoological Sciences at Carleton College. The staff of the Department includes: Neil S. Dungay, Frank R. Kille, and Roy A. Waggener, professors, and Olin Sewall Pettingill, Jr., associate professor.

*Ernst A. Scharrer*, Western Reserve University, has been appointed associate professor of anatomy in the School of Medicine, University of Colorado, Denver.

*Lee E. Yeager* has been named head of the wildlife research unit program in the Division of Wildlife Research, Department of the Interior's Fish and Wildlife Service. Dr. Yeager, who entered the Service more than a year ago as a biologist in the Office of the Coordinator of River Basin Studies, in his new post will also serve as liaison officer on Pittman-Robertson research projects to correlate scientific data acquired through expenditure of Federal aid in wildlife restoration funds. Work of the wildlife research units is conducted cooperatively between the Fish and Wildlife Service, 10 land-grant colleges, state game or conservation departments, and the American Wildlife Institute. Units have been established in the principal natural wildlife regions of the country to conduct investigations to furnish the scientific foundation upon which practical wildlife restoration and management practices can be based.

*Ludwik Anigstein*, professor of preventive medicine, University of Texas School of Medicine, has completed a four-month lecture tour in Poland as UNRRA lecturer on communicable diseases.

*Harold Chatland* and *Charles W. Vickery* have been appointed associate professors in the Department of Mathematics, The Ohio State University.

*C. Lloyd Claff*, Randolph, Massachusetts, presented a lecture on "Survival Mechanisms in Protozoa" at the Edward Martin Biological Laboratory, Swarthmore College, on 18 October.

*James E. McCormack* has been appointed assistant dean of the New York University College of Medicine.

*Edward A. Ackerman*, Department of Geography, Harvard University, is on a year's leave in Japan to act as technical coordinator and research supervisor. He recently contributed two of nine papers in a publication entitled "Japan's Prospect." Thomas R. Smith, formerly chief, Far Eastern Section, Division of Map Intelligence and Cartography, Department of State, will act as visiting lecturer during Prof. Ackerman's absence.

## Announcements

*President Truman has appointed a Presidential Research Board* headed by Reconversion Director John R. Steelman, who is charged with the responsibility of reporting on the present status of Federal research programs and making recommendations with respect to improving the coordination and the efficiency of scientific research in the Federal Government.

By the Executive Order signed on 17 October Mr. Steelman is also directed to relate his findings on "non-Federal research, development, and training activities." He is also to make "recommendations for planning, administering, and staffing Federal research programs to insure that the scientific personnel, training, and research facilities of the Nation are used most effectively in the national interest."

The President's statement, which accompanied his Executive Order, said:

National security and the development of the domestic economy depend upon the extension of fundamental scientific knowledge and the application of basic principles to the development of new techniques and processes. The Nation has a vast reservoir of war-accelerated technological development which must be applied speedily and effectively to the problems of peace—stepping up productivity in both industry and agriculture, creation of new farm and factory products, and advancement of medical science. Fundamental research, necessarily neglected during the war, must be resumed if scientific progress is to continue.

The Federal Government has played and will play an important role in all areas of research, but the share of our national income which can be devoted to research has definite limits. The order lays the groundwork for a general plan designed to insure that Federal scientific research will promote the most effective allocation of research resources between the universities, the research foundations, industry, and the Federal Government.

Mr. Steelman is to be advised in his task by those government agencies that are active in research. Specifically named were the Secretary of Agriculture, the Secretary of Commerce, the Secretary of the Interior, the Secretary of the Navy, the Secretary of War, the Federal Loan Administrator, the Federal Security Administrator, the Federal Works Administrator, the Director of the Office of Scientific Research and Development, the Chairman of the Federal Communications Commission, the Chairman of the Tennessee Valley Authority, and the Chairman of the National Advisory Committee for Aeronautics, each of whom may designate a full-time member of his staff as alternate to act in his stead.

*The University of Hawaii* announces that Robert W. Hiatt, associate professor of zoology, has been appointed chairman of the Department of Zoology and

Entomology. New appointees to the Department include: Albert H. Banner, marine zoologist recently released from duty with the 20th Air Force, Pauline Heizer, cytologist, and Gordon B. Mainland, geneticist, all assistant professors of zoology; and Donald C. Matthews, visiting professor of zoology.

*A. Irving Hallowell*, Department of Anthropology, Northwestern University, directed the work of six graduate students (Erika Eichhorn, Beatrice Mosner, Blanche Watrous, Ruy Coelho, Melford Spiro, from Northwestern University, and William Caudill, University of Chicago) who participated in a field project at Lac du Flambeau, Wisconsin, during the months of July and August. The project had a dual aim: (1) to collect data pertaining to the psychological effects of acculturation upon a group of Ojibwa Indians, and (2) to provide field experience for the students in the general area of culture and personality studies, particularly in the use of various projective techniques. Previous investigations of Prof. Hallowell among Canadian Indians with the same linguistic and cultural background who, during approximately the same period of time as the Ojibwa of northern Wisconsin, have remained much closer to their aboriginal mode of life, will provide a base line against which the results of the more accelerated changes at Lac du Flambeau can be measured.

Field headquarters were set up in a private summer home located on a wooded point overlooking the lake. Since funds were available only for traveling expenses, incidentals, and payment to informants, rent and living expenses were borne by the students themselves.

The projective technique employed to secure basic psychological data on individuals were the Rorschach and Thematic Apperception Tests. A large number of free drawings were also obtained. Supplementary information included life-history material, social and economic facts relevant to the contemporary situation, and some ethnographic data. Of a resident Indian population of approximately 800 individuals, 265 persons, ranging from under 6 to 80 years of age, comprise the total sample of those about whom some sort of data is on record. The most systematic information was obtained upon 100 children from 6 to 14 years of age. This included Rorschach and Thematic Apperception Test protocols, drawings in most cases, and information from school records.

*Vinyl butyral plastic*, long used as an interlayer material in safety glass, is ready for a broad-scale entry into the textile coating field, according to an announcement by the Monsanto Chemical Company. Describing the development as one which may ultimately enrich and simplify the lives of millions of housewives, Monsanto claims that it will make possible



such items as stainproof tablecloths, furniture slip-covers immune to ink, and draperies that can be wiped clean with a damp cloth. In sharp contrast with familiar rubberized or oilcloth-type coatings, the new application affords resistance to stains and water while allowing the fabric to retain much of its original appearance and touch qualities.

In the mill application process, there is bonded to the fabric a thin, almost invisible coating of flexible and transparent vinyl butyral—so tightly adhering that it will not chip or peel under normal usage, and so inconspicuous that only an expert can visually distinguish a properly coated cloth from an untreated companion cloth. Some merchandizing experts have expressed the opinion that the protective plastic makes the cloth more desirable and attractive from the standpoint of appearance, contending that it gives it a freshly-starched look and that it accentuates the brilliance of color patterns.

First plastic-protected articles to reach consumers will be gaily printed luncheon cloths, which are to be sold very shortly by a New York department store. Home tests conducted by Monsanto employees indicate that the luncheon cloths can be used continuously from 6 to 8 weeks, with a sponge-off after each meal, before the untreated underside picks up enough dust to require laundering.

Early in 1942 the Nation was without adequate supplies of rubber for textile coating purposes, while Monsanto—due to cutbacks in auto production—had a surplus capacity for production of vinyl butyral. Monsanto scientists collaborated with technologists of other companies (notably those of the Hodgman Rubber Company) to perfect an application technique whereby vinyl butyral could be calendered or spread-coated onto fabrics on existing mill equipment. The result was a coating of lighter weight, greater durability, more attractive appearance, and superior resistance to temperature extremes. It is estimated that some 26,000 miles of yard-wide fabric were coated with vinyl butyral for the armed services, principally for rain wear.

Since V-J Day the plastic and the process methods have undergone constant refinements. These have been directed mainly toward the goal of imparting waterproofness with minimum change in feel, texture, and appearance. It was stated that the plastic-protected fabrics will involve a slight cost increase, but this will be offset many times over by the functional advantages added.

Monsanto emphasized that it neither supplies fabrics, coats textiles, nor sells the finished material. Its function is merely that of a supplier of the plastic and of the technical knowledge required to apply it.

*Organization of a Survey Research Center*, to provide facilities for social and economic research and for student training in survey techniques, has been announced by the University of Michigan. The Center will be used to conduct surveys for governmental and commercial agencies on problems of economic, social, and psychological interest. The surveys will be conducted by detailed interviews on samples representing a national cross-section as well as on samples of small areas or regions or of special groups.

General policy for the new Center will be set by a University Executive Committee whose members are: Vice-President M. L. Niehuss, Russell A. Stevenson, dean of the School of Business Administration, R. C. Angell, A. W. Bromage, E. M. Hoover, and D. G. Marquis.

Rensis Likert, who has been appointed professor of psychology and sociology, is to be the director of the Center. The assistant director is Angus Campbell, newly appointed associate professor of sociology and psychology. Charles Cannell will be chief of the field staff; George Katona, research associate; and Eleanor Maceoby, study director. All were formerly in the Division of Program Surveys, U. S. Department of Agriculture.

*The Department of Zoology, Columbia University*, has announced the following appointments: Franz Schrader, executive officer; Teru Hayashi, of the University of Missouri, instructor in charge of the extension teaching of the Department; and Aubrey Gorman, of Wayne University, assistant professor of zoology at Barnard College.

*The potential brilliance of color television pictures* has been increased 11 times over that in January as a result of the development and use of a new set of color filters and an increase in the number of frames per second, Peter C. Goldmark, director of Engineering Research and Development, Columbia Broadcasting System, said in a report to the National Electronics Conference in Chicago on 3 October. The meeting was sponsored by the Illinois Institute of Technology, Northwestern University, University of Illinois, and American Institute of Electrical Engineers, with the cooperation of the Chicago Technical Societies Council.

The new filters alone permit an increase of two and one-half times in picture illumination. An increase in the color frame rate to 48 per second from the 40-frame rate used at the outset of this year itself permits an increase in brilliance of four and one-half times. In combination, the new filters and frame rate produce the 11-fold improvement.

In his paper on "Color Television—Latest State of

the Art," Dr. Goldmark discussed fundamental considerations of the theory behind color television and said that the CBS color television system permits results which surpass current photographic methods of reproducing color.

*Progress Thru Research*, a new magazine published by the Research Laboratories of General Mills, Inc., appeared on 1 October. Subsequent issues, to be published quarterly, will carry reports of General Mills' research activities, new products, new methods, and semipopular informational articles on scientific subjects.

The first issue contained an article on industrial uses of lecithin, a review of General Mills' research expansion program, and the details of their formula for calculating the storage life of cereal products. Copies will be distributed free within the continental limits of the United States; requests should be addressed to: General Mills Research Laboratories, 2010 East Hennepin Avenue, Minneapolis 13, Minnesota.

*The Department of Physics, Vanderbilt University*, Nashville, Tennessee, announces that Carl K. Seyfert, formerly of the Warner and Swasey Observatory, Case School of Applied Science, Cleveland, has been appointed associate professor of physics and director of the Observatory. John I. Hopkins, North Carolina State College, Raleigh, has been appointed assistant professor of physics. Both assumed their duties at the beginning of the fall quarter. Sherwood K. Haynes, who has been granted a year's leave of absence from the University, will work at the Clinton Laboratories, Oak Ridge, Tennessee, during the present school year.

*America's first mobile clinic* for providing eye care in remote areas was dedicated in Trenton, New Jersey, on 12 October. The 2½-ton unit, which is 19 feet long and more than 6 feet wide, was planned and equipped by Bausch and Lomb. Somewhat similar to the mobile optical units used overseas during the war by the armed forces, the rolling eye clinic will provide a public health service rivaling that of the mobile hospital clinics now in use in the South.

*A Conference on Genetics and Social Behavior* was held on 10-13 September at the Rosecoe B. Jackson Memorial Laboratory in Bar Harbor. The meeting was held in connection with the inauguration of a new program of behavior studies which was made possible by a recent Rockefeller Foundation grant.

R. M. Yerkes was general chairman of the Conference, and the members were divided into committees which led group discussions as follows: "Genetic Background of Social Behavior": W. L. Russell, F. A. Beach, C. E. Keeler, and G. W. Woolley; "Social Behavior and Motivation": Gardner Murphy, D. M.

Levy, N. E. Collias, and E. A. Beeman; "Abnormal Behavior and Emotions": H. S. Liddell, O. H. Mowrer, H. J. Bagg, C. S. Hall, J. L. Fuller, and D. T. Allen; "Intelligence and Learning": C. P. Stone, N. E. Miller, L. V. Searle, W. M. Dawson, T. C. Schneirla, and H. H. Strandkov; "Physiological Background of Behavior": C. T. Morgan, E. W. Dempsey, W. C. Young, B. Ginsburg, R. S. Morison, M. A. Kennard, and E. M. Vicari; and "Social Organization and Leadership": C. R. Carpenter, J. P. Scott, Lois Murphy, and R. M. Yerkes.

The preliminary reports of the committees summarized research which is urgently needed in the fields of psychobiology and sociobiology, and stressed the importance of cooperative work between institutions and individuals. It was suggested that the Jackson Laboratory emphasize the use of controlled genetic material as a tool for psychological and sociological experiments on animals, and continue cooperation with visiting research workers.

*A new laboratory unit at the Hanford atomic energy plant*, near Richland, Washington, has been announced by General Electric. Operation of the Hanford Engineer Works, where active material for atomic bombs was produced during the war, was taken over by the Company on 1 September. The activities of the new unit will be one phase of the extensive atomic energy research and development program which the Company is conducting for the Government at Hanford. William D. Coolidge, X-ray pioneer and consultant to the General Electric Research Laboratory, Schenectady, has been named head of the unit. Dr. Coolidge has been associated with the atomic bomb project since the spring of 1941, when he was named a member of the six-man reviewing committee, appointed by the National Academy of Sciences, to evaluate the military importance of the uranium problem and to recommend the level of expenditure at which the problem should be investigated.

*New appointments at Union College* include the following: Carl D. Hoeker, formerly of the Bell Telephone Laboratories, as associate professor of chemistry; Galen W. Ewing, formerly with the Winthrop Chemical Company, as assistant professor of chemistry; W. Max Schwarz, formerly of Indiana University, as assistant professor of physics; Marvin H. Little and Robert W. Finholt, as instructors in chemistry; and Jerome M. Rehr and Marshall C. Yovits, as instructors in physics. Alfred T. Goble has been named associate professor of physics after serving as lecturer since last November, and Frank J. Studer, who recently resigned to join the staff of the General Electric Company, has been appointed research professor to advise advanced students on their research projects.



*The amino acids of insects will be studied under a five-year research program at the Laboratories of Insect Physiology of the Department of Entomology, Cornell University. The work, which has been made possible by a grant from the Lalor Foundation, Wilmington, Delaware, will include studies on the identification of the amino acids in insects and the amino acid nutritional requirements of insects. The project supports two research fellowships, which have been awarded to H. L. House, on leave of absence from the Dominion Parasite Laboratory, Belleville, Ontario, Canada, and J. J. Pratt, Jr., recently discharged from the U. S. Public Health Service.*

*A pharmacological laboratory devoted to industrial research and consulting has been opened by Lloyd W. Hazleton near Falls Church, Virginia (P. O. Box 333). A principal objective of the laboratory will be the development of pharmacological background for compliance with regulations of Federal agencies, according to Dr. Hazleton, who has specialized in industrial pharmacological research for six years as an associate professor of pharmacology at George Washington University, Washington, D. C. His graduate work was done at the University of Washington, Seattle.*

*The Department of Botany, University of Tennessee, has announced the following changes in staff: L. R. Hesler, head of the Department since 1919, is to devote full time to the Liberal Arts College deanship; S. L. Meyer has been appointed professor and head of the Department; A. J. Sharp has returned from a two-year study in Mexico and Guatemala under a Guggenheim fellowship; S. A. Cain has resigned to become botanist to the Cranbrook Institute; and R. E. Shanks has been appointed associate professor.*

*Augusto Giovanardi, professor of hygiene and bacteriology, University of Padova, Italy, has written to Lotte Strauss, of Mount Sinai Hospital, stating that he is especially interested in receiving bibliographies, articles, abstracts, and journals concerning the methods of preparation of allergens for diagnostic purposes and of vaccines for desensitization. He also reports that the University has not yet begun to receive foreign journals.*

*A convocation commemorating the 100th anniversary of the founding of the Smithsonian Institution was held in the Natural History Building of the U. S. National Museum, Washington, D. C., on the evening of 23 October. The program was opened by Vannevar Bush, regent of the Institution, who presided. Felicitations were given by L. P. Eisenhart, speaking for the American Philosophical Society, and Frank B. Jewett, president of the National Academy of Sci-*

*ences. Dr. Jewett mentioned the close association between the Academy and the Institution during the past 83 years, stating that the Smithsonian was the Academy's domicile prior to its obtaining a home of its own and that all those who have served as secretaries of the Institution either have been or are members of the Academy. Alexander Wetmore, present secretary of the Smithsonian, responded, relating pertinent steps in its history since 10 August 1846, the date of its foundation. The main feature of the program was a lecture by Matthew W. Stirling, chief of the Bureau of American Ethnology, on "The La Venta Culture of Southern Mexico," illustrated by motion pictures in color. At the conclusion of the lecture an informal reception was held in the Rotunda of the Museum. The large number of invited guests included a distinguished group of foreign scientists, in this country to attend the recent meetings of the National Academy of Sciences and the American Philosophical Society.*

## Elections

*Frederick D. Rossini, chief, Thermochemistry and Hydrocarbons Section, National Bureau of Standards, has been elected president of the Standing Committee of Thermochemistry of the International Union of Chemistry, according to an announcement from the Bureau. The Standing Committee of Thermochemistry, consisting of chemists from Poland, France, Belgium, Holland, and the United States, is concerned with achieving international agreements for standards used in thermochemical investigations. The Committee plans to hold its first postwar meeting in London in July 1947. Dr. Rossini joined the staff of the National Bureau of Standards in 1928 as a physical chemist in the Thermochemical Laboratory and became chief of the Thermochemistry and Hydrocarbons Section in 1936.*

*A. B. Kinzel was re-elected chairman of the Engineering Foundation at the annual meeting of its Board on 17 October. Dr. Kinzel is vice-president of the Union Carbide and Carbon Research Laboratories, Inc., and of the Electro Metallurgical Company. During the war he was senior consultant of the Metals Branch of WPB, and chief consultant on metals to the Enemy Branch of FEA. Other officers elected were: L. W. Chubb, director of the Westinghouse Research Laboratories, vice-chairman; Edwin H. Colpitts, formerly vice-president of the Bell Telephone Laboratories, re-elected director; and John H. R. Arms, re-elected secretary.*

*Helen A. Hunscher, Western Reserve University, recently became president-elect of the American Dietetic Association for 1946-47.*

## Recent Deaths

*Henry Sherring Pratt*, 87, zoologist, died on 5 October. Dr. Pratt, who had been professor of biology at Haverford College, Pennsylvania, since 1898, was the author of several books on zoology and biology. He was an authority on the embryology and metamorphoses of insects.

*Frederick M. Prall*, 52, director of the Rayon Technical Patent Section, E. I. du Pont de Nemours and Company, died on 11 October.

*John Thomas McGill*, 94, died on 11 April. He was associated with Vanderbilt University, Nashville, from 1876 until 1919, when he retired as professor emeritus of organic chemistry. He had also served for 18 years as dean of the Department of Pharmacy, and was one of the founders of the Tennessee Academy of Science, of which he was elected honorary president for life in 1939.

*William N. Jennings*, 85, died on 9 September. A pioneer photographer, Mr. Jennings was the recipient of the John Price Wetherill Medal from the Franklin Institute, which was awarded for taking the first known photograph of a flash of lightning in 1882. He was also one of the founders of the American Museum of Photography.

## A New Laboratory of Applied Geophysics and Geochemistry, The Pennsylvania State College

A laboratory of applied geophysics and geochemistry has recently been established at The Pennsylvania State College under the direction of Sylvain J. Pirson. The program of work includes both resident instruction and fundamental as well as practical researches in the development of new mineral resources.

For the first time in the history of American academic institutions a course in geochemistry will be given at Penn State. A beginning was made, however, by the Graduate School of the Department of Agriculture, Washington, D. C., which introduced a course in the subject in 1943 under the charge of Dr. Chambliss.

Geochemistry, "stricto sensus," is not a well-known field in the United States, and in this respect we are possibly 20-25 years behind the Russians, who have produced outstanding modern geochemists, such as W. I. Vernadsky, A. E. Fersman, E. S. Federov, and others. Accordingly, the field of work should be defined and delineated in order that confusion may not exist with the meaning of the word "geochemistry" when used "lato sensus."

In its strictest sense, geochemistry is the study of

the origin, occurrence, association, abundance, migration, distribution, dispersion, and accumulation of atomic elements within the geosphere including the atmosphere. Since the earth is derived from cosmic matter, it is natural that the basis for a chemical understanding of the earth's atomic processes should be based on astrophysical and astrochemical concepts. The origin of matter and its evolution in the earth over astronomic time is the special field of geochemistry. The borderline fields of chemical and atomic physics provide the fundamental laws for this study: nuclear and electronic configurations of the atoms, atomic numbers and weights, atomic and ionic radii, coordination numbers, crystal structures, energies and lattices, etc. explain the paragenetic relationships of the 92 geochemical and of the possible transuranic elements.

The pragmatic aspect of geochemical sciences is not neglected in the new courses. The application of the principles of geochemical processes and associations is the basis of the long-range forecast of future reserves of essential industrial elements. An understanding of these principles will help to conceive, formulate, and develop new technological means for prospecting and delineating hidden mineral reserves. The method thus far best known in this country is geochemical prospecting for oil and gas fields, the principles of which are still taken as preposterous by much of the practical geological profession, notwithstanding some remarkable successes and a commendable score in the ratio of exploration successes to failures.

Compared to geochemical exploration for oil and gas, exploration for ore deposits has made but a timid start. The fundamental concept at the basis of these methods of approach is the ionic diffusion of elements to near-surface layers where their abnormal presence may be revealed by microanalytical tests of soils, ground water, and vegetation. Broad geochemical provinces may thus be outlined in which chemical concentrators (zonal distribution patterns), belts, zones, nodes, etc. may be delineated and the probable existence of hidden mineral treasures may be ascertained.

The standard methods of geophysical prospecting for minerals are not neglected in the Penn State program of study and research, nor are their most recent developments. A program of airborne magnetometer survey of part of the State of Pennsylvania in cooperation with the U. S. Geological Survey has been initiated, the purpose of which is to study the manner in which the parallel structures visible in the Allegheny Mountains may be traced into the Appalachian geosyncline, where deep oil and gas structures are expected to be found in close association with uplifts within the Pre-Cambrian basement rocks.



# In the Laboratory

## Bone Marrow of Horses and Cattle

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In a recent cytological study of the bone marrow of 7 horses and 14 head of cattle the range and mean cell counts were determined (Table 1). These figures compare favorably with those of other investigators (1-5).

A satisfactory procedure for extracting the marrow is presented below:

The 11th rib in the cow or the 11th to 16th ribs in the horse, at a level just below the long muscles of the back, are the best sites at which to secure the marrow sample. Confine the subject in a stock or restrain it against the side of the stall. Brush the back and side of the animal with a grooming brush and wipe with a damp cloth. Shave or clip the hair over the area, wash with soap solution, apply iodine, and

TABLE 1

SUMMARY OF BONE MARROW DATA ON THE COW AND HORSE

Cells	Cow		Horse	
	Range	Mean	Range	Mean
Stem cell . . . . .	0.0 - 5.0	2.14	0.4 - 3.4	1.6
Erythroblast . . . . .	11.8 - 42.8	30.26	8.0 - 32.0	20.94
Normoblast . . . . .	7.2 - 39.2	21.69	5.0 - 24.2	13.71
Total erythroid cells (E) . . . . .	21.0 - 72.2	52.66	19.0 - 47.6	34.66
Promyelocyte . . . . .	0.0 - 6.8	1.51	0.0 - 5.0	1.83
Neutrophilic myelocyte . . . . .	10.4 - 32.0	19.39	26.2 - 56.0	38.06
Neutrophil . . . . .	1.2 - 12.2	5.73	1.8 - 20.2	13.31
Eosinophilic myelocyte . . . . .	1.8 - 10.4	6.69	0.4 - 3.6	2.34
Eosinophil . . . . .	0.0 - 7.6	1.92	0.2 - 1.2	0.60
Basophils (all) . . . . .	0.0 - 1.0	0.34	0.0 - 1.0	0.60
Total myeloid cells (M) . . . . .	19.6 - 60.4	35.59	45.0 - 71.6	56.74
Monocyte . . . . .	0.0 - 7.6	2.64	1.2 - 4.8	2.46
Plasma cell . . . . .	0.2 - 2.0	0.79	0.0 - 0.8	0.63
Lymphocyte . . . . .	1.4 - 16.8	6.68	2.0 - 5.6	3.91
Megacaryocytes in 300 sq. mm. . . . .	0-121	25.14	0-8	1.71
Mitoses/500 cells . . . . .	0-11	4.9	0-8	2.71
Myeloid-erythroid ratio (M/E) . . . . .	0.27-2.5	0.676	0.94-3.76	1.64

anesthetize the skin, fascia, and periosteum with 2 per cent procaine hydrochloride. Using a hand drill equipped with a 3/32-inch jobbers' drill, bore into the center of the rib in order to hit the marrow cavity. The drill "gives" when it enters the cavity. Caution should be exercised not to miss the marrow cavity, because there is danger of entering the thoracic cavity. Remove the drill and insert a needle trocar with the same outside diameter as the drill. Remove the needle,

attach an airtight syringe, and aspirate 1 cc. or less of marrow. Pure marrow is more viscous than blood and greyish red. The sample is diluted more or less with blood, depending upon the amount of blood aspirated with the marrow.

The operative wound heals without leaving any visible scar once the hair has grown over it.

Obtain blood samples at the same time the marrow samples are taken. It is possible to carry out routine pipette filling and smear techniques at the side of the animal, but a better method is to use oxalate tubes and take the material to a laboratory for examination.

It is hoped that this technic and the data presented may encourage other investigators to include the marrow in routine hematological studies of both normal and disease processes of horses and cattle.

A more detailed report will be published elsewhere.

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## A Simple Vaporizing Device for the Attainment of Bactericidal Concentrations of Glycol Vapors in Air<sup>1</sup>

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University of Pennsylvania

It has been well established that bacteria and viruses retain their infectious properties when dried in air, and that such air-borne organisms can transmit respiratory infections over considerable intervals of space and time. Since this mode of transmission, as against direct contact and droplet transmission, is responsible for a considerable percentage of all respiratory infections, both sporadic and epidemic, and since it is not affected by the ordinary hygienic precautions even where they are applied, the disinfection of air in enclosed spaces is a major problem in the control of respiratory diseases.

The demonstration of the lethal effect of certain glycol vapors on air-borne bacteria (6) and influenza virus (5) obviously suggested another means of ap-

<sup>1</sup>The work described in this paper was done under a contract, recommended by the Committee on Medical Research, between the Office of Scientific Research and Development and the Children's Hospital of Philadelphia.

proaching the problem of disinfection of enclosed air besides that of ultraviolet irradiation.

Satisfactory results from the application of chemical disinfection of air to the control of air-borne cross-infection in human beings have already been published by the authors (4) and others (2). It was shown that the total rate of occurrence of respiratory infections was markedly decreased in a group of subjects in whose air supply a bactericidal concentration of glycol vapor was maintained. Devices for vaporization of glycols had been developed by the Research Corporation and by Bigg (1). It was felt in this laboratory, however, that the development of as simple a device as possible might favor wide application of chemical disinfection of air to the control of respiratory cross-infections.

For operation in relatively small enclosed spaces it was decided to make a small, portable unit, such as would maintain adequate concentration of glycol in a volume of air not so great as to involve problems of dispersal and distribution of the glycol vapors to be liberated by the device. For somewhat larger enclosed spaces it was thought better to use an appropriate number of such units rather than a single, more powerful one.

The apparatus, as developed, depends on the use of wicks and an ordinary electric light bulb. The wicks stand in a reservoir of glycol, with the upper ends at the level of the incandescent bulb. The glycol rises in the wicks by capillarity, and the radiant heat in the vicinity of the bulb causes the glycol at the top of the wick to evaporate. This is in turn replaced by additional glycol rising in the wick. The wicks are made of Fiberglas<sup>2</sup> in order to avoid carbonization by the higher temperature at the top. Although some heat is conducted down the wicks, the temperature of the reservoir does not rise above 50° C. Finally, a circular opening around the socket of the incandescent bulb admits air which, on being heated by the bulb, rises in a continuous upward stream, carrying off the glycol vapor.

The apparatus (Fig. 1) consists of a cylinder cut out at the center. The latter is open at the top and bottom, and in this space there is a socket for an electric light bulb. The top of the container, or glycol reservoir, is perforated by holes, 1 cm. in diameter, arranged in two circles concentric with the instrument itself. Through these holes pass the wicks of braided Fiberglas, which are somewhat frayed at both ends for greater efficiency. The wicks, 15 cm. long and terminating near the widest part of the incandescent

bulb, are fixed in their vertical position by being passed through a similarly perforated plate near the lower end of the reservoir. An approximately hemispherical dome containing a shell of glass-wool insulation, 10 cm. in height, surmounts the apparatus, and a hole 10 cm. in diameter is cut out at the very top for egress of the glycol vapor and of the warmed air which carries it off. A float gauge and a glare shield complete the apparatus.

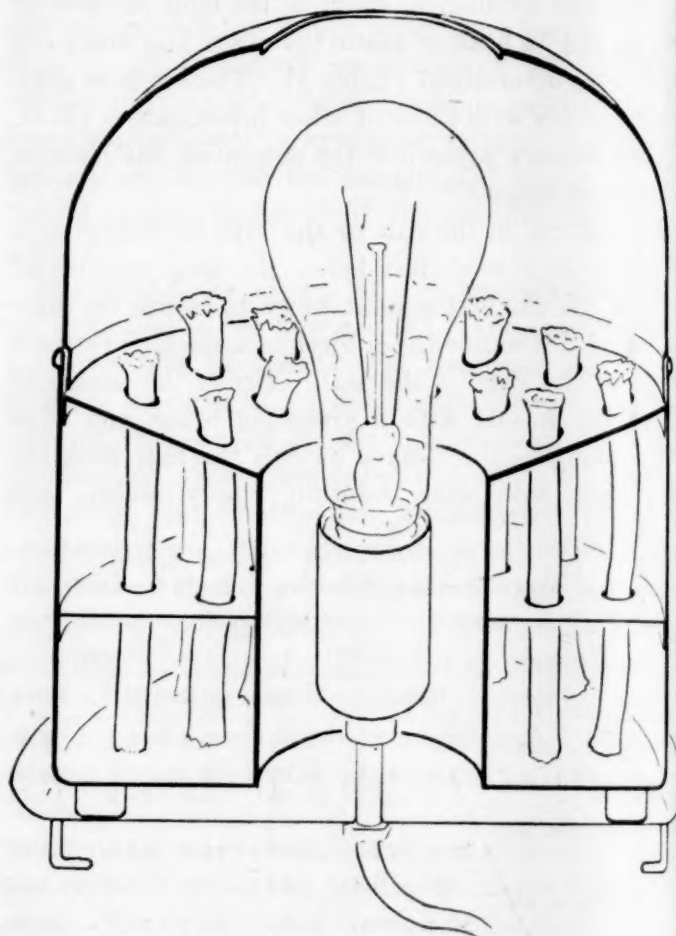


FIG. 1

The criterion of simplicity of construction and operation has been satisfied by the absence of any moving parts or valves. With respect to flexibility of operation, the output of glycol vapor in unit time can be regulated coarsely by changing the wattage of the bulb or quite finely (to a 4 per cent difference) by removing one or more wicks from the vaporizer. This flexibility is of importance in adjusting the device to the enclosed space in which it is to be used, in terms of volume of air, rate of air exchange, and activity of air currents.

With propylene glycol in use, the characteristics of this vaporizer are as follows: The rate of evaporation of the glycol, using a 100-watt bulb and all the wicks, in a room of about 20° C., is approximately 38 cc./hour. At a conservative estimate, it is calculated that this will supply 200 cubic feet/minute of outside air with glycol vapor to a concentration well above the bactericidal threshold. Stated in terms of volume

<sup>2</sup> The authors wish to express their thanks to Walter R. Sykes, of the Owens-Corning-Fiberglas Corporation, and to F. N. P. Supplee, a Philadelphia horticulturist, whose experience with Fiberglas wicking was of great use in the development of the vaporizer.



rate of air exchange, it would supply a volume of 1,300 cubic feet with 9 complete air changes per hour. With the vaporizer at room temperature, the vapors can be demonstrated above the apparatus within 2 minutes of turning on the switch of the incandescent bulb. When the apparatus was used in a room of 1,260 cubic feet, the glycol was dispersed to the corners of the room with sufficient rapidity to reach bactericidal concentration within 30 minutes, in the absence of any human activity except that of the operator.

A typical series of tests of the apparatus gave the following results: a 1:10 dilution of an 18-hour broth culture of Group C streptococci was sprayed into the corner of a room 9 × 9 × 15.5 feet, and the organisms were killed by mixing the output of the spray with many volumes of room air in a large bottle. The window was opened 1½ inches, and the relative humidity was 40%. After 10 minutes, the bacterial spray was discontinued, and one Petri plate was exposed for 5 minutes at each corner of the room, at table height. The glycol vaporizer was then attached to the electrical outlet. At various intervals thereafter the spraying of bacteria and the exposure of plates were repeated identically as in the case of the controls above. All plates were incubated for 48 hours at 37° C., and colony counts were then made. In this series of experiments the table supporting the bacterial spray and glycol vaporizer was near corner D and farthest from corner A (Table 1).

TABLE 1

CONTROL COLONY COUNTS AND COUNTS AT INTERVALS AFTER CONNECTING THE VAPORIZER TO THE ELECTRICAL OUTLET

Site	30 Minutes		60 Minutes		90 Minutes		120 Minutes	
	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5	Exp. 6	Exp. 7	Exp. 8
	Control	With glycol	Control	With glycol	Control	With glycol	Control	With glycol
A	339	28	280	20	99	1	252	3
B	322	14	272	10	97	1	238	2
C	280	37	252	14	87	0	220	1
D	374	3	208	3	94	1	231	1

Similarly satisfactory results were obtained on spraying *Escherichia coli* and *Staphylococcus albus*. The concentrations of bacteria in air produced by spraying in these tests are, of course, very many times the concentrations found by similar means in any normal habitation.

The application of this vaporizer is not predicated on the use of any particular glycol. At present there is no general agreement among all workers in the field as to the glycol of choice, and it is entirely possible that those in current use, propylene and triethylene, may be superseded. Propylene glycol was used in these experiments and seems at present to be preferable for the applications for which the device was in-

tended, i.e. small enclosed spaces not equipped with devices for regulating the rate of vaporization. The most important reason for this is that the wider range of concentration between bactericidal and precipitation thresholds in the case of propylene glycol obviates the necessity for special regulatory instruments.

Finally, no attempt was made, in developing this device, to provide means of controlling the relative humidity. Recent work by Hamburger, Hurst, Robertson, and Puck (3) has shown that, although the bactericidal effect of triethylene glycol vapor is greater in the presence of relative humidity above 40, it is only somewhat lower at a relative humidity of 18-30 per cent. Work done with propylene glycol in this laboratory is consistent with these findings. This minimum relative humidity is not higher than is necessary as a general hygienic measure and should be maintained by some means which is a part of the heating or ventilating apparatus. Hamburger, *et al.* suggest for the purpose steam caps in steam-heated interiors. In the apparatus described here the technical problems of simultaneous vaporization of glycol and water would defeat the original purpose of producing as simple a device as possible.

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### Fine-tapered Silver Electrodes for Physiological Work<sup>1</sup>

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In the course of electrophysiological studies of nerve activity in insects (1) fine and pliable electrodes were necessary. It was found that 28 to 36 B- and S-gauge silver wire was too coarse, while finer gauges were subject to whip and vibration. Conventional saline-filled glass capillary electrodes had the disadvantage of high electrical resistance, while it was impossible to bend such electrodes during an experiment to conform with the short nerves and narrow operational fields encountered in insects. Various mechanical methods of tapering silver wire were tried without success until a simple and rapid electrolytic method was developed.

Leads are soldered to short lengths of No. 28 B and S soft-drawn silver wire, which are mounted in a glass

<sup>1</sup> The electrodes were developed in the course of work done under a contract between the Chemical Warfare Service and Tufts College.

holder to be carried by the manipulator. A 50-ml. beaker is filled with 5 per cent aqueous silver nitrate in which a piece of silver wire is immersed. The latter is connected to the negative pole of a 6-volt d-c source (storage or dry batteries), while the leads from the electrodes are connected to the positive pole. The electrodes are rapidly immersed in the silver nitrate to a depth of about 2 mm. and immediately withdrawn. This is repeated four or five times, or until inspection under a microscope reveals tapered tips of the required shape and fineness. The angle of taper is determined by the speed of immersion and withdrawal, and can be varied accordingly. The silver remains soft and smooth and can be chlorided and insulated with shellac if desired. The great advantage of tapered silver electrodes is that the fine tips can be bent into any shape with fine forceps during the course of an experiment, and less than a minute is required to make new tapered tips, should the points break off.

The tendency to vibrate is slight since the electrodes can be made of relatively heavy silver wire, while the soft temper and fineness of the points greatly minimizes tissue damage which may occur when the electrodes are moved.

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### Use of Sulfuric Acid-Dichromate Mixture in Cleaning Glassware

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Concentrated sulfuric acid saturated with potassium or sodium dichromate has been used for many years in cleaning glassware. In 1934 Laug (3) found that, although 10 rinsings of glassware with water removed all dichromate from the glass surface, there were still appreciable amounts within the glass, and that if the glass were allowed contact with water for several hours, it would yield the dichromate to solution. For example, in one experiment with a pyrex beaker 1.3  $\mu\text{g}$ . of potassium dichromate was removed. Only by boiling it out with several successive changes of water could the dichromate be removed effectively. Richards (4) studied the effects of such small concentrations of dichromate on yeast and other microbial forms and found as little as 0.0001  $\mu\text{g}$ ./ml. to be toxic in some cases.

Because of the general use of this cleaning solution in most biological as well as chemical laboratories, it was considered of some importance to investigate further the retention of dichromate and the acid com-

ponent by glassware and the effect of dichromate on certain representative laboratory procedures.

Sulfuric acid-dichromate cleaning solution was made up in the usual way (250–300 ml. saturated potassium dichromate plus approximately 3,500 ml. technical concentrated sulfuric acid) and was found to contain 28,100  $\mu\text{g}$ . potassium dichromate/ml. (determined by iodimetry, using a solution of sodium thiosulfate standardized against potassium iodate). An extremely sensitive test for dichromate (1) entails the addition of diphenylcarbazide in an acid medium. The absorption curve of the resultant color product was determined on the Beckman spectrophotometer and a maximum extinction (E) observed at a wave length of 540 m $\mu$ . Working at this wave length, a curve relating concentration to E was established by which all subsequent analyses for dichromate were determined. By this method, as little as 0.01  $\mu\text{g}$ ./ml. can be detected. Determinations of pH were made using the Beckman pH meter.

Determinations of dichromate and pH were made on washings from a 5-ml. pyrex volumetric pipette, a 25-ml. pyrex volumetric flask, and a 250-ml. pyrex volumetric flask. The first 10 washes were done as rapidly as is usually done when washing glassware under a running faucet, and each washing was tested for pH and dichromate. In each case 6 to 10 rinses were required before the pH approximated that of the wash water. Four to 6 rinses removed most of the dichromate, although even after 10 rinses a small amount could be detected in some cases, e.g. the 10th washing from the 5-ml. pipette contained between 0.1 and 0.20  $\mu\text{g}$ . As would be expected because of the relatively large glass surface to its contained volume more rinses were required for a pipette than a flask. To demonstrate the quantity of absorbed dichromate not removed by such rapid washing, a 250-ml. pyrex volumetric flask was allowed contact with cleaning solution for 48 hours. The 11th rapid wash contained 0.1  $\mu\text{g}$ . dichromate. The flask was then filled with water and allowed to stand for 22 hours at room temperature, after which the wash was concentrated to 10 ml. by heat evaporation. This wash contained 0.1  $\mu\text{g}$ . dichromate.

The effect of dichromate on urease activity was determined by adding various amounts of dichromate solution to the reactants in a modified Karr method for determining urea nitrogen.<sup>1</sup> Dichromate in the range of 1–10  $\mu\text{g}$ ./ml. attained as much as 95 per cent inhibition of the enzyme urease. Since a direct relationship exists between enzyme concentration and concentration of inhibitor required for a specific amount

<sup>1</sup> A 1 per cent solution of Squibb's urease was used. The resulting ammonium carbonate solution (after reaction for 30 minutes at 55° C.) was nesslerized by Koch-McMeekin reagent. The color intensity was measured at a wave length of 425 m $\mu$  on the Coleman spectrophotometer.



of inhibition, less dichromate would be needed for an inhibition in cases where the enzyme concentration is decreased from that used in these particular experiments.

The effect of dichromate on growth of two strains of *Staphylococcus aureus* was followed turbidimetrically (at 450 m $\mu$ . on the Coleman spectrophotometer) and checked by duplicate pour-plate dilution counts. In synthetic medium<sup>2</sup> as little as 1  $\mu$ g./ml. was very toxic to growth, whereas in nutrient broth approximately 10 times as much dichromate was needed to obtain equivalent inhibition. This was undoubtedly

The medium used was that of Landy and Dicken (2) with the omission of sodium acetate, asparagine, guanine, xanthine, uracil, and folic acid.

due to binding of the heavy metal ion by constituents of the nutrient broth.

Because of the extreme difficulty in ridding glassware of dichromate after cleaning in "cleaning solution" and its great toxicity for living cells and enzymes, it is believed highly advisable in laboratories dealing with such material to clean all glassware by another method, such as 10 per cent nitric acid, a detergent, or 1-5 per cent trisodium phosphate.

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## Letters to the Editor

### The Effect of Urethane on Lymphatic Leukemia in Rats

In 1925 Hawkins and Murphy reported from this Laboratory that urethane anesthesia (ethyl carbamate) caused a rapid increase in the CO<sub>2</sub> content and pH of the whole blood of rabbits to a point where there was a marked uncompensated alkalosis. This reached its maximum in 24 hours and persisted for 48 hours. Accompanying this change was a marked fall in the circulating lymphocytes, similar in extent to that following a relatively large exposure to X-ray (*J. exp. Med.*, 1925, 42, 609). Recently an investigation has been undertaken to test the effect of urethane on the development of transplanted lymphatic leukemia and lymphosarcoma in rats. Since starting this study, our attention has been called to two articles which have appeared in British journals. Haddow and Sexton, in testing urethanes on experimental animal tumors, noted that the most striking effect was upon leukemic cells (*Nature, Lond.*, 1946, 157, 500). In the second paper, Paterson, Haddow, Thomas, and Watkinson compared the effect of urethane with deep X-ray on human leukemia (*Lancet*, 1946, 11 May, 677). They noted that the chemical agent produced a remarkably similar effect on the blood count and the enlarged lymph nodes to that resulting from the application of the standard method of deep X-ray therapy.

The material for our test was a transplanted disease of rats, which manifests itself as generalized lymphatic leukemia if the malignant cells are injected intraperitoneally or as a localized lymphosarcoma when the cells are inoculated into the subcutaneous tissue of the groin. The leukemic type of the disease develops rapidly, with a marked increase in the circulating lymphocytes and extensive involvement of the thymus and lymph nodes. Death results in 8 to 12 days. The groin inoculations result in rapidly growing tumors which attain very large size and cause death of the rats in 16 to 21 days.

Among 50 inoculated rats, given from 50 to 100 mg.

of urethane/100 grams of body weight, repeated 4 times a week, only 3 developed leukemia (6 per cent). Among 41 controls of the same strain, inoculated with the same material but receiving no treatment, 33 developed fatal leukemia (80.4 per cent). Among 30 rats inoculated in the groin with leukemia cells, and given the urethane treatment, only 9 (30 per cent) developed progressive tumors, while 26 of the 30 controls (86.6 per cent) died of lymphosarcoma.

We have previously demonstrated that adrenalectomy renders rats much more susceptible to our strain of leukemia (*Science*, 1943, 98, 568). Furthermore, adrenal cortical and pituitary adenotropic hormones retard or prevent the development of the disease (*Science*, 1944, 99, 303). In the light of these observations it may prove significant that the adrenals of rats given urethane in the dosage employed above show about 33 per cent increase in weight over those from normal, untreated animals. A similar increase in weight of the adrenals has been noted in rats which develop resistance to inoculated leukemic cells without treatment. We are attempting to evaluate the part played by the adrenals by treating inoculated, adrenalectomized rats with urethane.

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### Wild Pineapples in Venezuela

Although pineapples, *Ananas ananas* (L.) Cockerell (*A. sativus* Schult. f.) were known to have originated in the American tropics and have been reported growing in the wild state in Brazil, Surinam, and Paraguay (*Pflanzenfam.* (2nd ed.), 1930, p. 154), not until recent observations by the author and V. Badillo in the Parguasa region of the Estado Bolívar, and simultaneously by others in neighboring regions, have they been definitely known to be in the wild state in Venezuela. They grow

under a variety of conditions ranging from dense shade under warm, humid forest to edges of forest. There seem to exist several varieties or forms, differing in fruit size and taste and in leaf characters. Among the latter may be mentioned complete absence of thorns in leaves, more so than in the Smooth Cayenne cultivated variety. Others have thorns retrorsely and antrorsely oriented. One such variety differs so little from its relative, *Bromelia Pinguin* L., that only the expert natives (Piaroa Indians) could distinguish them. While only one variety growing wild was found sweet and palatable enough to be desirable, Piaroa Indians have had under cultivation since time immemorial some varieties which yield large, tasty fruits. The wild varieties have abundant seed, one ovary alone having yielded 14. This is in contrast to the present commercial varieties and the sparingly established Pan de Azúcar in P. R., which are largely seedless. Samples of all of these have been brought to the Institute of Tropical Agriculture, at Mayagüez, Puerto Rico, to be used for breeding purposes if they survive there.

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#### A Nutritional Concept of Cancer

While the etiology of cancer has been categorized under infection by a transmissible virus on the one hand and gene mutation on the other (not to mention a host of other hypotheses), there has been relatively little speculation on the biochemical mechanisms whereby any of these events could lead to the process recognized as neoplastic growth. Recent studies by Beadle, Tatum, and others, on the genetic control of biosynthetic reactions in the fungus, *Neurospora*, have provided a foundation for new concepts of the biological regulation of growth. In particular, a study by Ryan and Lederberg (*Proc. nat. Acad. Sci., Wash.*, 1946, 32, 163-173), on the "adaptation" of a *Neurospora* mutant deficient in the synthesis of leucine, has provided an experimental basis for speculative analogy with neoplasia.

Field strains of *Neurospora* will grow on medium containing only sugar, salts, and biotin, which is to say that the fungus is capable of manufacturing all other essential metabolites. As the result of mutations of single genes, the capacity for synthesis of various compounds may be lost. A similar process presumably accounts for the nutritional requirements of higher forms.

Following ultraviolet treatment, a mutant strain of *Neurospora*, #33757, has been isolated which is incapable of synthesizing leucine. As a consequence, this strain requires leucine, and its growth is quantitatively regulated by the available supply.

Occasionally, cultures of leucineless *Neurospora* grown on limiting amounts of this amino acid will "adapt"; that is, an exceptional fragment of the mycelium will grow autonomously, irrespective of the available leucine, and may under certain conditions overgrow the culture until the sugar is exhausted. By genetic analysis of crosses between adapted and wild strains, it has been

shown that adaptation depends on the mutation, or reversion, of the leucineless gene to an allele capable of mediating the synthesis of leucine.

A culture of leucineless *Neurospora* has, then, two growth potentialities: a regulated growth corresponding to the leucine externally available to it, and, exceptionally, autonomous growth on the basis of a gene mutation leading to the synthesis of that metabolite.

If one correlates normal tissue cells with a culture of leucineless *Neurospora*, both regulated by their environment, a simple analogy for cancer is evident—the newly found capacity of a cell to synthesize an essential metabolite otherwise available only in limiting and regulatory amounts.

While the *Neurospora* experiments suggest a mutational origin for this capacity, virus infection, by providing a missing link for a blocked enzyme system, could play a corresponding role. A consequence of this simple concept is that cancer cells may be found to differ in their growth factor requirements from cells of normal origin when they are grown *in vitro*.

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#### Education and the Foundations of Science

It is no surprise that students and leading citizens should make as poor a showing on Dr. Ralph H. Ojemann's tests of their conception and appreciation of scientific research as that exhibited in his article (*Science*, 1946, 104, 335-338). Dr. Ojemann has evidently presumed that a pupil who has studied sciences for some years will have learned what he calls "the basic concepts involved," including, especially, one which he identifies as "study through controlled variables" (which he also calls "the most dependable type of study"). Such a presumption is unfortunately not to be justified by reference to the laboratory or to popular textbooks. Rules and procedures are learned, more or less, as are the results they produce; but the idea or philosophy of the business is either wanting altogether, or else set forth without explanation or quite arbitrarily and dogmatically.

This, however, is no wonder. Suppose an explanation of the method of "controlled variables" were undertaken; if it were of scholarly competence, it would shortly lead to Mill's celebrated *Methods of Experimental Enquiry*, since this particular method is but an application of one or two of these. But alas—these themselves are far from rigorous, as the explanation would also demonstrate. Supposing that it was intended to seek farther for an explanation; the concept of method *per se* and of explanation *per se* would demand attention. These are chiefly logical and epistemological matters. But logical and epistemological matters are little considered in American education. It is then a matter of course that students and others, even though long devoted to science, should be at a loss when confronted with problems which presuppose competence in those unknown directions.



An interesting remark of Dr. Ojemann is that knowledge "grows by research and only by research." If he means here "experiment," then nearly everything in logic and mathematics will be excluded. So, too, will be the whole thinking, theoretical, hypothetical side of experimental science. If, on the other hand, Dr. Ojemann's meaning is that research and knowledge are synonymous, then many who never performed an experiment or did any other kind of scientific work must be considered research men, some of them very high in the scale.

This ambiguity of the term "research" may partly excuse the poor showing of those who submitted to the questioning which Dr. Ojemann describes. The uncertain or unexamined status of some of the "basic concepts" to which he refers may be a further excuse. The complete absence of anything which could be considered philosophy of science will excuse still more (in the pupils, not the educators). Whether any sins are left for which the pupils are the ones responsible, or for which the scientists and educators themselves are excusable, is a nice question.

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#### On Methods of Food Appraisal

In a series of reports published by the Naval Medical Research Institute, Bethesda, Maryland, Cdr. C. M. McCay and associates have described the nutritive value of food consumed at several naval shore stations and at one Army camp. In each of these reports a comparison has been made between the analytical value of the diet consumed and the calculated value of the diet issued. While such comparisons could hardly be expected to show close agreement, they nevertheless serve the valuable purpose of emphasizing the inadequacy of ordinary Tables of Food Composition when used for purposes of appraising cooked, ready-to-serve food. This point is not particularly emphasized in Cdr. McCay's reports, however, and as a result, an occasional question has arisen concerning what might appear to be an unfavorable reflection upon the principle of appraising food "as issued."

The original purpose of appraising Army food as issued was to provide a check on the adequacy of menu planning in relation to levels of nutrients recommended for the promotion of nutritional health. This method was later extended to include the appraisal of uncooked food used in the kitchen. Finally, an average deduction was usually made in recognition of loss of food during preparation for cooking (*i.e.* inedible garbage), and also of the losses of fat (and therefore calories) as well as vitamins during the cooking process itself. Because of the wide variability of both preparation and cooking losses, the usual objective attained was the appraisal of the approximate nutritive value likely to be found at three levels of messing operations, *i.e.* good, fair, and poor.

It is quite obvious that such appraisals were aimed primarily at checking the adequacy of food planning, rather than the exact determination of the nutrients to be found in the food finally consumed. Therein lie the

chief differences between the two methods of appraisal used for comparative purposes by Cdr. McCay. As mentioned above, the discrepancies in results point to a possible need for nutritive values of *cooked foods*—but at that point one is immediately faced with some difficult questions, chiefly concerning the degree of applicability of such values. In other words, who could assure duplication of the messing operations that were present when the original nutritive values of cooked foods were obtained? Kitchen operations vary not only from mess to mess but also from day to day within the same mess. Variability in recipes and in final moisture content would present innumerable difficulties. In addition, no one familiar with nutritional surveys would deny the attempts of mess personnel to do better during a survey, and the customary relaxation back to "normal" (poor) cooking practices upon the departure of the "inspectors" from the mess under survey. There are also other non-reproducible factors, particularly related to the variability of the initial nutrient content found in raw as well as canned foods.

It is apparent to the undersigned that in spite of inherent shortcomings, both methods can be used to advantage through the simple process of consolidation. Unannounced spot surveys carried out by the actual analysis of cooked food can give a continuous measure of adequacy of food actually consumed, and can also indicate where emphasis is required in courses of instruction given in service schools training mess personnel. In addition, the initial planning of the food to be issued should be checked routinely by preappraisal of the nutrients likely to be found in the uncooked (A.P.) food listed on the menu. Because of the multiplicity of factors that will affect the terminal nutritive value of such food when cooked, the desirability of spending too much time on preappraisal is doubtful. For this reason there has been developed and described in the literature a short method of evaluation of diets based on the use of nutritive values derived for 15 food groups. It has been shown that when this method is properly adapted, the appraisal of A.P. food which is obtained by its use is reasonably close to that obtained using the "long" method involving individual values for individual foods. It is regrettable that there can be no magic formula for conversion to the values found when the food has been stored, prepared for cooking, cooked, and then finally served, regardless of which method is used, either "short" or "long."

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#### Growth of Ragweed for Its Medicinal Virtues in the Dominican Republic

In the United States, in Argentina, and perhaps in other countries, ragweed, because of its irritating pollen, is very much condemned as a most troublesome weed.

The junior author of this note, who has been engaged for several years in rubber investigations in the Dominican Republic, wishes to report that ragweed in this

country is esteemed as a plant with beneficial medicinal properties. What has proven to be the species *Ambrosia monophylla* (Walt.) Rydb. (*A. paniculata* Michx.) is cultivated in gardens by the country folk, to be used for poultices in the treatment of various pains and ills. It is actually sold in the market places of the capital city, Trujillo, for this purpose. Plants secured here were grown to the flowering stage and herbarium material prepared under the senior author's field number, 13876, and deposited in the U. S. National Herbarium at Washington, D. C.

During his stay of three years in Costa Rica, where he was engaged in rubber investigations at Turrialba, the junior author saw no ragweeds at any time. In the

Dominican Republic they are very uncommon and appear to be unimportant constituents of the flora.

Certain individuals who were highly allergic to ragweed pollens in the United States have found complete freedom in Haiti and the Dominican Republic, apparently because of the scarcity of members of the genus *Ambrosia* here. During a recent extensive collecting trip in the Dominican Republic through November, December, January, and the first week of February, 1945-46, the senior author encountered no wild *Ambrosia* species.

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## Book Reviews

*The California ground squirrel: a record of observations made on the Hastings Natural History Reservation.* Jean M. Linsdale. Berkeley-Los Angeles: Univ. California Press, 1946. Pp. xi + 475. (Illustrated.) \$5.00.

Students of behavior of wild animals, epidemiologists, administrative heads of rodent control programs in western North America, and students of natural history will find in this book a wealth of sound, basic information that they cannot afford to miss. Seldom has a single species of animal been studied so thoroughly and from so many angles of approach, particularly in its wild surroundings, as has the California ground squirrel. Little has escaped the critical eyes of Dr. Linsdale and his co-workers on the Hastings Reservation. Such inclusive topics as where and how this squirrel lives, communication, behaviorisms, food and shelter, populations, reproduction, diseases, parasites, and general morphology are all treated in more or less detail. There is some repetition in both text and half-tones (the latter of which are not up to the usual standards of the University of California Press), but this does not detract from the real value of the book as source material. The student of populations will have some difficulty in trying to find out how many squirrels there were in a unit area at any season of the year, but perhaps Dr. Linsdale does not consider this phase of population study important.

One of the more interesting conclusions is that the California ground squirrel prefers land that is being cultivated or pastured to those areas where the vegetation, particularly grass, is allowed to grow tall. Control of habitat, then, is the most effective method of controlling these ground squirrels. It is possible that this principle might be applied with success rather generally in the animal world. It might be inferred from the above that these rodents were much less numerous in the past than they are now—that human habitation has made for the squirrels a better place in which to live. Or could it be that the squirrels have changed their habits within historic times?

It is hoped that other studies of this nature will be forthcoming from the Hastings Reservation.

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*A treasury of science.* Harlow Shapley, Samuel Rapport, and Helen Wright. (Eds.) New York-London: Harper, 1946. Pp. xii + 772. \$3.95.

First published in 1943, *A treasury of science* continues to be a distinguished anthology of informative, thought-provoking, and entertaining hors d'oeuvres and entrees painstakingly selected by the editors from the vast storehouse of scientific writing. Deliberately chosen for the ubiquitous T. C. Mits, the celebrated man in the street invented by H. G. and L. R. Lieber, these readings will also repay the scientist for his time.

For those who are being introduced to the *Treasury* for the first time it may be useful to outline briefly the basic structure of this anthology.

After a delightful introduction by the principal editor, Harlow Shapley, there follow five additional sections: "Science and the Scientist," "The Physical World," "The World of Life," "The World of Man," and finally, "Atomic Fission." The sequence of sections is reminiscent of the Biblical dictum: "Dust thou art, and unto dust shalt thou return." A modern paraphrase might read: "By fission was life begun; by fission it may end."

The section on "Atomic Fission" is new in this edition and includes selections from the writings of H. D. Smyth, E. O. Lawrence, J. Viner, and R. J. Oppenheimer.

Authors whose writings appear in earlier parts of the book include Oliver La Farge, Eddington, Jeans, Pavlov, Curie, Franklin, Stefansson, Huxley, Heiser, Kaempfer, Moulton, Einstein, and Geddes.

This volume is recommended for rereading as well as reading.

MORRIS C. LEIKINEN

Library of Congress, Washington, D. C.